Laurel Valley Sugar Plantation: Sugar Mill
2 miles south of Thibodaux on State Route 308
Thibodaux
Lafourche Parish
Louisiana

HAER No. LA-1A

HAER
LA,
29-THIB,
1A-

PHOTOGRAPHS
REDUCED COPIES OF MEASURED DRAWINGS
WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
U.S. Department of the Interior
Washington, DC 20240

HAER
LA,
29-THIB,
1A-

HISTORIC AMERICAN ENGINEERING RECORD
LAUREL VALLEY PROJECT
SUMMER 1978

| | |
|---|---|
| Name: | LAUREL VALLEY SUGARHOUSE<br>LAUREL VALLEY PLANTATION |
| Location: | State Route 2, 1.5 miles north of Highway 308, Thibodaux, Louisiana |
| Date of Construction: | Originally built, c. 1840<br>Additions, c. 1895 -- 1900 |
| Present Owner: | Laurel Valley Plantation, Inc. |
| Present Use: | Abandoned (Destroyed by hurricane, 1965) |
| Significance: | Although the building has been ruined, a large collection of plantation records covering the period 1897 -- 1926 has survived. Thus the manufacture of sugar can be examined from the perspective of a typical early Twentieth Century sugarhouse. |
| Historian: | John C. Rumm |

# I. A TECHNOLOGICAL HISTORY OF THE LOUISIANA SUGAR INDUSTRY THROUGH THE CIVIL WAR PERIOD

Planters from many nearby estates gathered at the plantation of Etienne de Bore some six miles above New Orleans one day late in 1795. They had come to witness an experiment, the results of which, if successful, would affect their future and possibly the history of the entire region. Their attention was directed at a large circular iron pan arranged atop a brick furnace. Inside the pan, heated by the fire beneath, a yellowish syrup boiled and bubbled. De Bore, standing beside the furnace, motioned to his attendant, Antoine Morin, who reached a thumb and forefinger into the syrup and pulled out a small glob of the material. As he drew his fingers apart, the thread of the yellowish syrup sparkled with tiny crystals. "It granulates," announced de Bore. "The wonderful tidings" of what he had declared "flowed from mouth to mouth and went dying in the distance as if a hundred glad echoes were talking to one another."[1]

The crowd that eventful morning had witnessed the first successful demonstration of the making of sugar from sugar cane in Louisiana. De Bore's experiment earned him instant recognition as the "saviour of Louisiana," for he had accomplished a feat which had eluded scores of planters for decades. His success insured that a viable sugar cane industry could develop in the region.

It was in 1751 that a group of Jesuit priests had first cultivated sugar cane in Louisiana, on a small estate in New Orleans.[2] They made no effort to manufacture sugar from their crop, however, and it was not until eight years later that a planter named Debreuil erected the first sugar mill in the area. His effort to manufacture sugar failed, as did the efforts of other planters who attempted the task for themselves. They failed to appreciate the art that was sugar-making -- to understand the care and the attention which the process of making sugar required, from the moment the juice first ran from the crushed cane stalks, to the moment when the boiling syrup reached its point of granulation. The task required experience and skill in recognizing at what point in the process each step had to be initiated, and the early Louisiana sugar-makers lacked that experience. As each planter met with failure, it seemed altogether possible that the sugar industry, the basis for much hope in the hearts of the settlers, might prove impossible for Louisiana. Nonetheless, a few undaunted planters continued to grow their cane to supply the markets of New Orleans.[3]

It was a determined planter, Antonio Mendez, who firmly resolved in 1791 to devote himelf to sugar manufacture "and to conquer all difficulties." Having purchased sugar-making apparatus, he secured the services of a Cuban sugar-maker, Antoine Morin, and placed him in charge of the sugarhouse. Morin's years of experience in making sugar in the West Indies paid off, for he produced a small quantity of sugar. Though the amount was not large, it nevertheless demonstrated that the manufacture of sugar on a larger scale did indeed seem feasible for Louisiana.[4]

The fact, remained, however, that no one had yet done this. Mendez's few barrels of sugar were still regarded as a curiosity. But the success of Etienne de Bore a few years later convinced nearly everyone that the sugar industry had begun. De Bore had acquired Morin's services from Mendez and had invested a large amount of capital in his sugar machinery. The results, as we have seen, showed that sugar could be manufactured in large quantities if planters were willing to follow his example and commit themselves to similar large investments. Apparently, many were. By 1802 the amount of sugar delivered to markets in New Orleans had reached over 5,000,000 lbs. per year.[5] Thousands of slaves were imported to compose the plantation labor force, and on hundreds of estates sugar cane was put into cultivation and sugarhouse were erected.

As much as possible, these early planters tied themselves to the lands on which they laid out their estates. Their sugarhouses were almost always constructed fairly close to a waterway -- the Mississippi River, or one of the many bayous which flowed sluggishly through the back regions of Louisiana. The closeness of the waterway not only insured a constant supply of water for the sugarhouse, but also provided a transportation outlet for delivering the finished sugar to market. Most sugarhouses were also placed near a forest, since planters needed a constant supply of wood for fuel. The timber also provided building materials, along with the soil for making bricks.

The sugarhouse formed the center of the plantation complex. Through the middle of the plantation ran a road from forty to sixty feet wide, with small roads crisscrossing it. Ditches flanked the roads and were cut through the fields, to remove as much as possible the water which would collect on the level ground. The plantation labor force, most of whom lived in the small cabins that surrounded the sugarhouse, kept the ditches and roads in order throughout the year. Maintaining the roads was critical, for they were the courses used "in hauling the wood from the swamps, the cane from the fields, and the crop to the river for shipment."[6]

Planters constructed their sugarhouses according to a standard plan, a _T_-shaped building whose stem pointed towards the nearby waterway. The stem, two stories high, some 150 feet in length and 50 to 60 feet in breadth, housed the cane mill and the kettles for boiling the juice into syrup. The head of the _T_, one story high and 30 to 40 feet in length, contained the purgery where molasses was drained from the newly-formed sugar crystals.[7]

In these early days of sugar-making, mule carts delivered the harvested cane to the cane shed located next to the mill. Here from 50 to 100 loads of cane could be stored for protection from the elements until ready to be ground. Workers fed stalks of cane into a mill consisting of three vertical or horizontal rolls made of stone or iron. A team of horses or oxen turned the mill, crushing the tough stalks to extract juice. The mill, raised off the ground, enabled juice to flow freely by gravity into large cypress vats in the mill room. These rectangular vats, containing several hundred gallons of juice, held the juice until it was able to be boiled. Screens within the vats removed larger particles of fibrous cane trash (bagasse) before the juice went to the kettles.

The four iron kettles, ranging in size from the _grande_ (72 inches in diameter) to the _batterie_ (54 inches), were arranged in a line above a brick furnace. Juice was piped to the kettles and two clarifying agents, lime and sulphur, were added to it. As the juice heated, these two agents caused a scum of impurities to form on its surface. Attendants removed the scum using long copper skimmers. This process of clarifying the juice continued, and as it did the water in the juice evaporated, causing the juice to become more concentrated. When the juice became sufficiently concentrated in the grande, it was ladled to the next pan, the flambeau, and more fresh juice was added to the grande. In the same fashion, juice was ladled from the flambeau to the sirop, and from the sirop to the batterie. Scums from the three pans were ladled back, in turn, to the grande where they acted as a charge for the fresh juice.

Boiling one run or charge of juice into syrup took about an hour. At its "striking" point, the moment when the concentrated syrup was ready to granulate, it was quickly scooped from the batterie into one of several shallow cypress boxes. In these boxes, or "coolers," the syrup hardened into sugar crystals. Attemdants stirred the mass of crystals from time to time to give a good texture and consistency to the mass. When it hardened sufficiently, it was broken up and put into hogsheads.

The hogsheads holding the sugar were carried into the purgery for draining molasses. To accomplish this, each barrel was placed on a framework running crosswise above a brick and cement molasses cistern. Molasses drained from the kegs through small holes in their bottoms; over a three-week period, some 40 0r 50 gallons flowed from each barrel. At the end of this period the barrels were plugged, sealed, and carted to the waterway for shipment to market. The floors of the molasses cisterns yielded, after the molasses had been drained away, an inferior grade of "cistern bottoms" sugar which could be marketed or used as a charge for fresh strikes of syrup.[8]

This method of manufacturing sugar continued to be employed in Louisiana (and in other Southern states) as the sugar industry developed during the early 1800's. A major stimulant to the growth of the industry occurred with the Louisiana Purchase in 1803, as thousands of settlers seeking livelihoods poured into the area from the North and from nearby territory. These immigrants quickly settled the most desirable regions in the fertile lands above New Orleans along the Mississippi.[9] Most brought with them capital sufficient not only to raise sugar cane, but to manufacture it as well. By 1824, some 193 sugarhouses had been erected in this area. Another major boost for the early sugar industry came after 1820 when former cotton planters from Mississippi and Alambama, having abandoned their fields due to a severely depressed cotton market, entered Louisiana seeking new wealth in the sugar business. By 1830 there were nearly 700 estates in Louisiana raising and manufacturing sugar.[10] One of the ex-cotton planters who came in with this mid-1820's tide was one Joseph W. Tucker, who, settling along Bayou Lafourche, established Laurel Valley Plantation in 1832.[11]

Along with these influxes of settlers came several innovations to improve the traditional method of making sugar. The first major innovation was the adoption of steam power to replace animals for driving cane mills. As early as 1812 Governor W.C. Claiborne had suggested that

> if the force of Steam, could be applied to Sugar Mills, & in a manner simple & not attended with great expense, the invention would greatly contribute to the welfare of this territory. . . .[12]

The order books of an English foundry, Fawcett, Preston & Company, indicate that between 1813 and 1817 at least three low-pressure steam engines were sent to Louisiana for driving mills. By the early 1820's several plantations employed steam mills for grinding cane.[13] Such mills consisted of three heavy cast iron rolls, a top roll set above a cane roll (entrance) and a discharge roll (exit). Numerous grooves cut into the face of each roll "provided a very free exit for the juice" as it was squeezed from the cane stalks.[14] The juice collected in a special pan built into the solid bed-plate of the mill, and it was drawn off through a stopcock into vats much like the older method.

The steam mill soon found favor with many planters, not only becasue it proved more reliable than animals, but also because it permitted a much higher percentage of extraction of juice than had been possible with animal mills -- as much as 65 percent.[15] At first, however, few could afford the $12,000 required to purchase a steam engine complete with mill. Foundries in the northern states, especially in Ohio and New York, reduced the cost of the mills as more were produced, and while the price was still fairly high, by 1828 82 of 308 Louisiana sugarhouses had obtained them.[16]

The earliest steam engines used in Louisiana had been of the low-pressure variety, but after 1830 more and more planters purchased high-pressure engines. Smaller in size and bulk, easier to service and repair, these engines were reportedly "less expensive in their construction" than low-pressure engines.[17] By 1838, according to a census of stationary steam engines taken in that year, over 200 engines were used in Louisiana, for powering not only sugar mills but saw mills and cotton gins as well. The number of engines used placed Louisiana second only to Pennsylvainia nationwide.[18] By 1860 and the advent of the Civil War, steam mills could be found on 1027 of 1291 plantations in Louisiana.

The conversion to steam mills forced a change in the old process of hand-feeding cane into the mill. Now that steam was available, "power was easily obtained and machinery was brought to relieve the laborers of this . . . most unpleasant duty."[19] The machinery employed, the cane carrier, consisted of an inclined plane some 4o to 5o feet in length. "Double chains with wooden slats, inserted crosswise into the alternate and larger links," formed "a moveable band about two feet wide around revolving cylinders."[20] These cylinders were kept in motion by the moving force of the mill. Workers now laid the cane onto the moving band of the carrier, placing the stalks so that they would not jam up upon entering the mill. The carrier, reported a witness, delivered its load of cane "quietly to its destination."[21]

The switch to steam power affected not only the grinding of cane but also the conversion of the juice into syrup. The larger amounts of juice being extracted from the canes put an increasing load on the kettles and the workers to keep up with the supply. It was for this reason, plus the fact that open kettles generally produced poorer quality sugars, that a great deal of effort was expended both in America and in Europe, to develop new methods of manufacturing sugar. These efforts paid off during the period 1830 to 1860, when "spectacular advances in the processes of clarification and evaporation" were achieved.[22]

In this country several advances were made in adopting the existing open train of kettles to boiling with steam. One approach set the train directly above a steam boiler. Others forced steam through steam jackets, or through pipes coiled into the bottom of the kettle. In yet another alternative, the kettles were abandoned altogether and were replaced by "steam boxes" in which the juice was piped from box to box to form a layer over a network of perforated steam pipes.[23] All of these suggestions, despite any improvements in the quality of the sugar they may have prodcued, suffered from the same disadvantage -- they, like their open kettle predecessor, wasted fuel.

Our energy-starved population may fail to appreciate the fact that earlier Americans also faced energy crises of their own. This was especially true in Louisiana, where the forests and swamps behind many sugar plantations had become depleted of most of their timber. As one observer reported,

> The amount of fuel consumed in the production of sugar is enormous. Three cords are on an average necessary for the manufacture of a hogshead of sugar of one thousand pounds. . . . This wood will readily sell to the steamboats throughout the sugar region of Louisiana for three dollars per cord; consequently, each thousand hogsheads of costs nine thousand dollars in its manufacture for wood alone.[24]

Many planters believed that a cure for the fuel shortage lay in the prospect of using bagasse for fuel. This practice was widespread in the West Indies where the cane trash, dried under the hot sun, "burn/ed/ under the sugar kettles with a vehemence which defies comparison."[25] The damper and cooler climate of Louisiana, however, meant that if planters hoped to use bagasse, they would either have to dry it indoors or burn it green. This was not possible, however, until 1853 when Samuel Fiske invented a furnace fitted with horizontal grate bars upon which green bagasse could be burned.[26]

The steps leading to the introduction of a method of making sugar which would at once combine economy of manufacture and a high-quality product, began with the invention of the vacuum pan. The operation of this device depended upon basic physical principles. In open air at sea level, water boils and changes to steam at a temperature of 212° Fahreheit (100° Centigrade). If, however, a partial vacuum is created so that the air pressure acting upon the water is largely withdrawn, the water can then be made to boil at temperatures below 212°. A vacuum produced with an air-pump, for example, can enable water to boil at 120°. This principle of boiling in lower-than-normal pressures also holds true for other liquids, saccharine solutions for example. Chemists had learned by the early 1800's that saccharine solutions, when boiled under partial vacuum conditions at lower-than-normal temperatures (235° Fahrenheit being the normal temperature), retained their crystalline structures. This realization, if put to practical use, would perhaps allow economy of fuel if sugar could be made at lower temperatures.[27]

It was E.C. Howard, an Englishman, who first invented the "vacuum pan" based upon these principles. His device, introduced in 1813, and similar vacuum pans appearing soon afterwards from others, consisted of

> an iron vessel . . . generally made cylindrical, air-tight, connected by an air-pump worked by the steam-engine, whereby the air is withdrawn from the pan to an extent sufficient to diminish the pressure of the atmosphere so far as to enable us to boil the syrup at a temperature varying from 130 to 160 degrees, instead of 235 or 240 degrees, which is the boiling point of syrup in the open air when concentrated to the density of 42° or 43° of the saccharimeter.[28]

Howard's vaccum pan found widespread acceptance at first in Europe alone, and it was not until 1830 that Thomas Morgan, a planter below New Orleans, first introduced it into Louisiana. His installation functioned as a strike pan, in which the vacuum pan received syrup which had been heated to the boiling-point but had been removed from the fire before reaching the strike-point. It would be allowed to reach this point and to commence its granulation inside the pan. "The results of the vacuum pan," noted one historian, "were watched with an interest scarcely less than that exhibited in De Bore's first attempt at sugar-making."[29] For Morgan and for Valcour Aime, another planter who introduced a vacuum pan into his sugarhouse soon afterwards, "it was a success from the start. Their experiments were wonderfully successful, producing a very high grade of refined sugar."[30]

The sugars which resulted were of high quality for several reasons. First, in the open kettles, the syrup reached a temperature of 240$^{\circ}$ or more; in the vacuum pan, however, the highest temperatures averaged about 150$^{\circ}$. This led to a smoother grain and a greater consistency in the syrup. When the syrup reached its striking-point, it was impossible to simply stop the fire beneath the kettles. Thus, remarked one observer,

> during the whole time that the sugar boiler is occupied in discharging the battery, the syrup is becoming more and more heated, that which is on the edge of the surface next to the metal becomes burnt or carmelized, and is not only lost but imparts a deeper color to the rest of the syrup. . . .[31]

A second advantage offered by the vacuum pan, therefore, was that the sugar-boiler could simply shut off the steam intake valve leading into the pan when the syrup reached its striking-point.

He could also adjust this valve, once granulation had begun in the pan, to regulate the grain formation of the sugar as desired -- a capability not available in the kettles and coolers. The final advantage of the vacuum pan pertained to the formation of molasses. In open kettles, the molasses which drained in the purgery could not be boiled back again to produce more sugar. Re-heating the syrup to 240° in this fashion would result in the same symptoms of carmelization mentioned above. In the vacuum pan, however,

> "the re-boiling of the syrups which drain from the first sugars is a regular part of the daily work; and this re-boiling has been effected three times, with successful results of crystallized sugar each time."[32]

Thus the vacuum pan appeared to be the answer to higher quality sugar production. It produced a high grade of sugar, and it also permittted the planter to make more sugars by boiling back the molasses which drained off from previous strikes. In the matter of economy of fuel, however, the vacuum pan still posed problems for planters whose fuel supplies were reduced. Most vacuum pans consumed as much wood as did open kettles. When high pressure steam kettles were used with a strike vacuum pan, fuel consumption jumped 25 percent above open kettles, with as much as 6 cords of wood required for 1000 pounds of sugar.[33]

Another factor of economy involved the maintenance of a vacuum in the pan. Most pans relied upon air-pumps, a proceedure which required "a large amount of motive power."[34] Various forms of condensers were used as well to maintain the vacuum, the most prevalent form consisting of:

> "a reservoir for steam (at a little distance from the vacuum pan), into which was poured through an

> extensive strainer, a large amount of cold water, which had for effect, after the expulsion of the air and supply of its place by vapor, to condense the vapor as rapidly as formed, and thereby maintain a perfect vacuum."[35]

These condensing cisterns required great volumes of cold water however, and their use was thus limited "to such localities as offer sufficient supply."[36] To furnish this water to the sugarhouse, pumping stations had to be erected leading from the nearest waterway to a pond near the sugarhouse from which the water could be obtained.

A final consideration of economy in the use of the vacuum pan was that, although condensers could be used to recover most of the steam required for heating the syrup, steam released as the syrup evaporated usually was allowed to escape. That such a useful source of heat simply dissipated away without being put to good use distressed many experts. "Unless the vapor taken off can be used as a fund of heat," remarked one expert, " there is no economy of fuel in the use of a vacuum pan more than in the open pan."[37]

The man who solved the problem of producing high-quality sugar while preserving economy of operation was Norbert Rillieux. Born in Louisiana in 1806, Rillieux studied physics and mechanics at the l'Ecole Centrale in Paris from 1830 to 1832. His interest in sugar manufacturing, and his familiarity with recent European improvements in the field, led him to conceive the idea of "multiple effect" evaporation. He proposed utilizing the steam released by evaporating syrup in the vacuum pan, to boil syrup in a second pan. He also suggested that this steam could be condensed and then directed back to the boilers for re-use. Returning to Louisiana in 1833, Rillieux spent several years developing his system, and in August 1843 he received U.S. Patent 3237 for an "Improvement in Sugar Works."[38] In this patent he claimed, among other things,

> a vacuum pan, or pans; that is to say, an evaporating pan or pans, connected with a condenser, in combination with an evaporating pan, or pans . . . in which the saccharine juice, or other fluid, is evaporated under a pressure, lower, equal to, or greater than, the atmosphere, which last mentioned pan . . . prepares the saccharine juice . . . from the vacuum pan, or pans, and at the same time supplies the necessary vapor from the saccharine juice . . . to complete the evaporation or concentration of the syrup . . . in the vacuum pan, or pans.[39]

Each vessel in Rillieux's multiple effect train consisted of three basic components: a steam-drum or "calandria," fitted with copper tubes through which juice passed; a down-take pipe which carried the juice back to the bottom of the vessel after it had boiled up through tubes in the calandria; and a vapor-space, linked by a pipe with the calandria of the next vessel in the train.[40]

Before entering the effect, juice which had been clarified was first filtered through a large cylindrical tank containing charcoal or bone-black. These filtrates removed the lime added before clarification, and also purged the juice of a great deal of its yellowish color so that a whiter sugar would result.[41] The juice then entered the calandria tubes of the first vessel. A vacuum-pump operating off a steam engine created a low degree of vacuum in this vessel, sufficient to permit its ebullition at a lower-than-normal temperature. Exhaust steam from the same engine or from a boiler was circulated around the calandria tubes, causing the juice within to boil.

Steam released during this first evaporation passed through the vapor-space pipe into the calandria of the next vessel. A pressure pump forced the juice from the first vessel into the second vessel, causing the steam to come into contact with it as the juice flowed through the calandria tubes. This contact condensed the steam, forming a vacuum (at a higher degree of vacuum than the first pan, so that the juice in the second vessel would boil at a still lower temperature), and the heat released from this condensation caused the juice to boil again. Both the steam produced by this evaporation, and the concentrated juice, then went to the next vessel and the process was repeated.[42]

Initially the final vessel of the multiple effect was used as a granulation pan for the syrup. In most plantations, however, this was eventually replaced by a system in which the granulation occurred in a separate vacuum pan after the syrup had been allowed to settle in tanks after leaving the effect. Two or three vessels comprised the multiple effect (in Europe, as many as five or six were sometimes used), the number employed being determined by the quantity of heat available, the amount of evaporation required, and the costs of an extra vessel and the fuel for it.[43] In most cases the double effect proved ample for the amount of evaporation needed in the sugarhouse.

Rillieux's multiple effect brought him deserved acclaim throughout Louisiana. His first full-scale version, a triple-effect erected at the Myrtle Grove Plantation of Theodore Packwood and Judiah P. Benjamin in 1846, proved a tremendous success. The "crystalline grain and snowy whiteness" of the sugars it made, declared Benjamin, led to a product "equal to those of the best double-refined sugar of our northern refineries."[44] By the end of the year multiple effects had been installed in at least eight sugarhouses in Louisiana. Within a few years the effect found use as well in Cuba and Mexico, and by 1850 refineries in Europe had adopted it.[45]

It was not only the quality of the sugars produced which convinced planters of the merits of the multiple effect; more important, perhaps, was its economy of operation. For planters who relied upon wood for fuel, consumption ranged from 9/10 to 1½ cords per hogshead for a double effect, and from 3/4 to 1½ cords for a triple effect.[46] "To planters who are obliged to depend greatly upon the begassa of the crop for their supply of fuel," noted one authority, "Rillieux's system presents great advantage over all others; for the economy of fuel is so great in it that the begassa alone is amply sufficient for the crop."[47]

The economies of water and steam were other advantages offered by the multiple effect. Here was a system in which the steam of evaporation could be used both to create a partial vacuum and also to boil juice into syrup within that vacuum. Thus this apparatus did not require the use of vacuum pumps and condensers for each separate vessel, the steam within serving that purpose. Water condensing from the first effect was free of sugar and could be used immeditely in the boilers after it passed through a cooling-tower. "Entrainment," or the presence of juice in condensation water, sometimes occurred in successive vessels, preventing the use of this water because it would foam in the boilers. Most effects, however, were fitted with special baffle-traps and catch-alls to keep sugar from entering the water.[48] The water, drawn off from the calandria beneath each vessel, could thus also be cooled and re-used. The water savings were substantial compared to other methods, in which much water simply dissipated in the form of steam, or in which large amounts of water were needed in the condensing cisterns. In the multiple effect, the juice condensed the steam at the same time it itself was being acted upon, thereby saving a large quantity of water. "The planter who is accustomed to see the enormous quantity of vapor that is carried off into the air through his steam chimney when he boils in the open kettles," said Benjamin, "can form some idea of the great economy that must necessarily result . . ." when using the multiple effect.[49]

Thus by 1850 several of the processes still used in Louisiana sugar factories today had appeared -- the steam mill, the bagasse furnace, the vacuum pan, and the multiple effect. Other pieces of equipment appeared in the next decade and have become part of the modern sugar industry. Among these was the process of multiple milling, which appeared during the early 1850's. Using two sets of three rollers arranged in sequence, a planter could extract more of the precious juice from his canes. Special devices to soak or spray the bagasse as it emerged from the first set of rolls not only washed juice from the cane trash, but turned the trash into a softer pulp from which more juice could be squeezed in the next set of rolls.[50]

Another innovation, the centrifugal machine, originated in Europe among beet sugar manufacturers and was adopted in Louisiana during the early 1850's. This machine consisted of a cylindrical perforated basket, surrounded by a stationary chamber, much in the manner of a modern washing machine. The basket received a charge of molasses and sugar crystals from the multiple effect or strike vacuum pan and revolved at a very high rate of speed. This forced the molasses to separate from the crystals and pass through the perforations into the casing, from which they could be discharged into a tank to be boiled back as second sugar.[51] Thus this eliminated the need for a system of purgeries to slowly separate the molasses from the sugar.

Another important innovation to appear during the 1850's, the use of sulphur dioxide to treat the cane juice, became a characteristic feature of the Louisiana sugar industry since it was only practiced to a large extent in this region. Sulphur, heated in a cast iron oven, formed sulphur dioxide gas. A gooseneck pipe passed these fumes into a wooden tank filled with cane juice from the mills, and mixers or agitators in the tank mixed the fumes into the juice. This process helped bleach the juice of its yellowish color and reduced its viscosity so that it boiled more freely.[52]

The use of sulphur dioxide pointed out the growing value placed upon the use of chemistry and scientific knowledge among planters. Many planters experimented, some more successfully than others, with various materials designed to better clarify their cane juice -- alum, blood, and boneblack being among the most commonly tested. Nearly every planter knew of instruments such as the saccharimeter, a device to measure the purity of the sugar, and after vacuum pans and effects became more popular in Louisiana sugarhouse, it was not uncommon to find planters installing laboratories and hiring chemists for their sugarhouses to gain some degree of technical control over the quality of their sugars.

To be sure, for most planters expenses such as these proved much too costly to muster. Refurbishing his sugarhouse was unthinkable for the small planter, and many who could afford to modernize their factories did not witness the fruits of their efforts for several seasons after their initial investment. Nonetheless the inducements to modernize proved compelling for many planters. One visitor to Louisiana commented in 1853 that

> it would be impossible to give a correct idea of the immense amount of money lavished upon /sugarhouses/, not only for things acknowledged to be useful and positively necessary, but more particularly for apparatus to be used in the manufacture of the crop. Hundreds of thousands of dollars annually find their way to the coffers of the Northern artisans . . . to improve upon the machinery used in the crystallization of sugar, and so willing are the spirited planters to beautify and adorn their sugar houses, that mills and engines are now erected, that in elaborate workmanship seem rather for ornament than for use.[53]

The onset of the Civil War in 1861, of course, changed all of this and brought the rush for improvement to a swift and tragic end. A Southern historian's grim words convey the impact of the war upon sugar manufacture in Louisiana:

> With the war came destruction, complete and effective. The slaves were freed, sugar houses destroyed, many of the owners killed. . . . The industry was thrown back where it was in 1795 directly after De Bore's success, with this difference, then (1795) labor was organized and abundant, lands plentiful and planters ready and eager, and financially able, to embark in the sugar industry.[54]

## Notes to Section One

1

W.C. Stubbs, Origin and Evolution of the Sugar Industry of Louisiana" in *A Standard History of New Orleans, Louisiana*, Henry Rightor, ed., p. 651.

2

*Ibid.*, p. 648.

3

*Ibid.*, pp. 648-649.

4

*Ibid.*, pp. 650-651.

5

*Ibid.*, p. 657. Planters also manufactured 200,000 gallons of rum and 250,000 gallons of malasses per year.

6

T.B. Thorpe, "Sugar and the Sugar Regions of Louisiana," *Harper's New Monthly Magazine*, 7 (June-November 1853) p. 758.

7

Benjamin Silliman, *Manual on the Cultivation of the Sugar Cane and the Fabrication and Refinement of Sugar*, p. 30.

8

*Ibid.*, pp. 30-41; J. Carlyle Sitterson, *Sugar Country: The Cane Sugar Industry in the South, 1753-1950*, pp. 137-144.

9

Sitterson, p. 23.

10

Sitterson, p. 28.

11

Paul Leslie, "Laurel Valley Sugar Plantation," p. 7.

12

W.C. Claiborne to Robert R Livingston, New York, 26 January 1812, in *Official Letter Books of W.C. Claiborne, 1801-1816*, Dunbar Roland, ed., Vol. 6, p. 41. The esteemed civil engineer Benjamin Henry Latrobe had also conceived of using steam engines to drive Louisiana's sugar mills in 1812. Latrobe suggested to Robert Fulton that they establish a foundry in Pittsburgh to build these engines, but when they differed on funding the venture, it fell through. (Carrol W. Pursell, Early Stationary Steam Engines in America, pp. 63-64.)

13

Noel Deerr, The History of Sugar, Vol. II, p. 553. See also the Woodbury census of stationary steam engines in America in 1838 (House Executive Documents, 25th Congress, 3rd Session, II, No. 345, returns for Louisiana, pps 305-309), and Raymond M. Wik, Steam Power on the American Farm, pps. 6-12, for further information on these early steam mills in Louisiana.

14

Guilford L. Spencer, A Handbook for Cane-Sugar Manufacturers and Their Chemists, 2nd Edition, pps. 15-17.

15

Sitterson, pp. 138-139.

16

Stubbs, p. 668; Pursell, p. 74.

17

Silliman, p. 31.

18

Pursell. pp. 72-73; Woodbury Census, pp. 305-309. The Louisiana compiler for the 1838 census, James Breedlove, reported that he had not listed all of the steam engines in the state since "they are scattered over such an extent of territory that to collect them would be impractical ... nearly all use cylinder boilers, and employ, on an average, 30 pounds pressure of steam to the square inch." He estimated that some 175 engines, used for saw mills and cotton gins as well as for sugar mills, had not been enumerated. ( Woodbury, p. 305.)

19

Thorpe, pp. 763-764.

20

Silliman, p. 31.

21

Thorpe, p. 764.

22

Sitterson, p. 146.

23

These and other versions of steam kettles are described more fully in "Manufacture of Sugar In Louisiana," De Bow's Review, 3(1847), pp. 386-391.

24

Thorpe, p. 758.

25

Ibid.

26

Sitterson, p. 152. Solon Robinson, a correspondent for the American Agriculturalist, whose "Agricultural Towns South and West" took him to several Louisiana sugar plantations, noted a few plantations where bagasse was being used as fuel in 1849. At Ormond Plantation, he wrote, he "first learned the value of bagasse as fuel. Here is a very well-arranged plan of saving and burning it .... This year, 350 hogsheads were made with this, alone, for fuel under the kettles." (Solon Robinson, "Agricultural Towns South and West, No, 6," in Solon Robinson, Pioneer and Agriculturalist, Selected Writings, Herbert Anthony Kellar, ed., Vol. II, p. 168.) These furnaces required, however, the drying of the bagasse before use, while Thompson's invention employed fresh green bagasse.

27

Noel Deerr, Cane Sugar, p 283; J.P. Benjamin, "Louisiana Sugar," De Bow's Review 4 (1846), p. 339.

28

Benjamin, pp. 339-340.

29

Stubbs, p. 668.

30

Ibid.

31

Benjamin, p. 343.

32

Ibid., p. 334.

33

Norbert Rillieux to W.E. Thompson, 29 January 1848, in "Sugar Making in Louisiana," De Bow's Review, 5 (1848), p. 285.

34
"Manufacture of Sugar In Louisiana," p. 391.

35
Ibid.

36
Ibid., p. 392.

37
Ibid., p. 389.

38
Sitterson, pp. 147-148. Rillieux, a free quadroon, returned to Paris in 1861 because of "the slights to which his African ancestry exposed him." (Deerr, The History of Sugar, Vol. II, pp. 566-567.)

39
"Recent American Patents," Journal of the Franklin Institute, 3rd Series, Vol. 18 (1849), p. 479.

40
Spencer, pp. 78-79.

41
Benjamin, p. 338.

42
Spencer, pp. 78-79; Benjamin, pp. 338-339

43
N.A. Helmer, "Evaporation in Multiple Effects," (Paper delivered before the Louisiana Sugar Planters'Association, 13 June 1907), p. 2. (Louisiana Sugar Planters' Association Papers, Louisiana State University Library Archives, Baton Rouge.)

44
Sitterson, p. 46.

45
"Improvements in Sugar," Journal of the Franklin Institute, 3rd Series, Vol. 19 (1850). p, 133; Deerr, The History of Sugar, Vol., 2, p. 569.

46
Rillieux to Thompson, p. 285.

47
Ibid.

48
W.H.P. Creighton, "Evaporating and Juice Heating," in Spencer, pp. 357-358.

49
Benjamin, p. 340.

50
Sitterson, pp. 139, 282.

51
Deerr, Cane Sugar, p. 372.

52
Spencer, p. 74.

53
Thorpe, p. 758.

54
Stubbs, p. 660.

# II. LAUREL VALLEY SUGARHOUSE

Laurel Valley Plantation had fared well under the management of Joseph Tucker since 1832. Gradually buying out the farms of smaller planters in the vicinity, Tucker increased Laurel Valley's total acreage from 815 to nearly 5,000 by the early 1840's. He constructed a brick sugarhouse according to the customary plan, installed open kettles and other equipment for making sugar, built quarters for the 118 slaves he owned, and began producing sugar. His managerial skills soon brought the plantation to the forefront among estates in Lafourche Parish in terms of sugar production.[1] Keeping some 600 to 1000 acres of his land in sugar cane cultivation annually, Tucker generally produced some 600 hogsheads or so of sugar per year (one hogshead = 1000 pounds of sugar).

When Joseph Tucker died in 1852 his cousin, Caleb, succeeded him as manager of Laurel Valley. Carrying on in Joseph's footsteps, he maintained the high levels of sugar production which characterized the plantation during the antebellum years.

The Civil War seriously disrupted operations at Laurel Valley. Sugar production continued during the early years of the war, but in 1863 Caleb joined the Confederate forces to fight at Vicksburg. Federal authorities, acting upon an order issued the previous year "subjecting the property of Louisianians who hereafter bore arms against the United States government to confiscation," seized his plantation.[2] Six hundred hogsheads of sugar and over 1200 barrels of molasses were removed, along with nearly every other piece of property. Caleb was killed at the Battle of Vicksburg and his heirs, returning to Laurel Valley at war's end in 1865, found "nothing comparatively on the Plantation, and everything almost a wreck."[3] It was left to the administrator of the Joseph Tucker estate, Louis Bush, to bring some semblance of order to Laurel Valley, but, other than contracting with tenant laborers to assist in "grinding, rolling, and manufacturing the sugar,"[4] and repairing "the Brick of the Cisterns in Sugar House,"[5] Bush could do little to improve circumstances. When Joseph Pennington Tucker assumed the management of the plantation in 1869, he found that

> . . . the machinery . . . at the Sugar House required thorough repairing; the Juice Boxes, Coolers and Cisterns had to be renewed; a boiler was needed for the Pump at the Lafourche.[6]

It is not known whether Tucker, his plantation burdened with indebtedness, actually effected these repairs. Plantation records from this period do reveal that "4 Steam Float Boxes made to order complete" were purchased from Daniel and Jas. D. Edwards in New Orleans, "Manufacturers of improved sugar trains."[7]

Debts continued to accumulate on the plantation until finally Bush petitioned for it to be sold at auction to satisfy the creditors. After the initial sale in March 1872, Laurel Valley passed through several hands before Burch Wormald acquired it in July 1874. Wormald, hoping to return the plantation to its antebellum level of sugar production, refurbished the outmoded sugarhouse, replacing the open kettles and steam train with a vacuum pan and centrifugals.[8] His improvements did lead to increased yields for the plantation, but they also increased its debts; in 1892 he too was forced to turn the estate over, to the New Orleans firm of

Behan and Zuberbier.

Early the following year Laurel Valley again went up on the auction block. According to the Lafourche Comet, a local newspaper, it sold for $70,600 and

> Messrs. Barker and Lepine were the purchasers. This is one of the finest sugar estates in Louisiana and the present owners have secured a bargain in getting it for the price they paid for it.[9]

Frank Barker and J. Wilson Lepine were no strangers to the plantation business. Their partnership extended back to 1885 when they purchased Melodia Plantation, an estate of some 1000 acres located four miles southeast of Laurel Valley.[10] Their operations at Melodia had proven successful, and the pair wished to make further gains in the sugar industry. Barker, who in 1897 would move to New Orleans to conduct "an extensive commission and brokerage business,"[11] left the management of daily operations on the two estates to Lepine. Lepine enjoyed the daily regimen of the sugar plantation. The Laurel Valley diaries kept by the plantation bookkeepers from 1903 to 1916 portray him as a manager who routinely visited the sugarhouse to inspect affairs or to tinker with machinery. From 1893 until his death in 1926 he would prove an efficient manager of Laurel Valley, a man whom workers respected and who played an important role in the life of Lafourche Parish.

One of the first actions taken by the new owners of the plantation in 1893 was to announce plans for a narrow gauge railroad to link the fields at Melodia and Laurel Valley with the Laurel Valley Sugarhouse. Along the route between the two plantations, it would also receive cane from smaller planters wishing to have their crop manufactured into sugar.[12] Barker and Lepine also began acquiring new equipment for their sugarhouse, including a second vacuum pan and vacuum pump.[13] Although they hoped to begin sugar production with the start of the grinding season in late October, it was not until November 14 that the Sugarhouse commenced operations. The Lafourche Comet noted that "after many accidents and setbacks . . . the mill is now running smoothly and giving satisfactory results."[14]

The inital season volume of sugar reached more than 2.5 million pounds, and pleased with this success Barker and Lepine began making further improvements in the Sugarhouse. New equipment added by 1900 included an electric light plant, boilers equipped with oil burners, a double effect, and a crusher for the mill room. By 1901 the factory was described in The Southern Manufacturer as "very modernly equipped." The Sugarhouse, which Barker and Lepine had also expanded in size by adding another story to the original brick building, contained

> a six roller mill and crusher, two Corliss engines, standard double effect, a seven and a half and a ten foot pan, ten centrifugals, four large magma tanks of fifty thousand gallons capacity, each, hot room capacity of four hundred and fifty cars, and in feeding cane they use a Bodley Mallon Cane Feeder and the American Hoist and Derrick. The plant is fully lighted throughout by an electric light plant . . . [15] The daily capacity [of the mill] is six hundred tons.

From 1901 onward Lepine continued to make changes in the Sugarhouse as older equipment became outmoded or as production demanded. Some measure of the changes made will be furnished by a list of the improvements, in the appendix to this report. Evidence of change in the Sugarhouse may also be seen by comparing two inventories of the factory, one from 1909 and the other from 1919, which are reprinted in the appendix along with a description of the factory as it was in 1926, the year operations ceased.

As businessmen, Barker and Lepine were motivated to improve conditions in the Sugarhouse out of their awareness of the influence of the sugar market in plantation operations. Buyers of plantation goods at the Sugar Exchange in New Orleans, where the daily transactions in sugar and molasses were conducted, gave the best prices to planters whose products were of high quality. The trade in these products was greatly conditioned by the color and the purity of the sugars, and the chemical content of the molasses, which were sold. Planters brought samples of their products to the Exchange in hopes of obtaining a good offer from a prospective buyer. Thus to fetch the best price for his product, the planter had to insure that it was of very high quality.

Before any sugar left the Sugarhouse, it was taken to the laboratory to be evaluated. The laboratory at Laurel Valley, which Lepine had installed in 1916 above the main office, contained all the equipment needed for this evaluation, including chemicals, scales, and instruments.[16] The most important instrument in the laboratory was the polariscope, also known as the polarimeter or saccharimeter. This device provided the planter with an estimate of the sucrose level of the sugar. It operated on the principle that sacchrined solutions rotated the plane of a ray of polarized light. Light from an external source entered the lens of the polarimeter and was polarized by a prism "made from a rhombohedron cut from a transparent crystal of Iceland spar."[17] The polarized light ray, known as the extraordinary ray, then passed through a tube containing the saccharine solution. The sucrose within the solution rotated the plane of the ray to the right. The amount of this rotation varied with the strength of the solution.[18] A standard weight of pure sucrose in solution with a standard quantity of pure water, when placed in a tube of given length, rotated the ray of light to a point marked as $100^{\circ}$ on a polarimetric reference scale. Using the same quantity of water to form the solution, but varying the concentration of sucrose within the solution, would show a rotation expressed in percentage of the standard of $100^{\circ}$.[19] The Sugar Excahnge based the market price for sugars manufactured in Lousiana on a purity of $96^{\circ}$; sugars showing this level of sucrose content would receive the current market price, while levels above or below this would sell for more or less than the going price.[20]

The higher grades of sugar were those classified as "plantation granulated." These sugars had a high sucrose content since they were manufactured from pure syrup ("first sugar") or from the molasses obtained from first sugars in the centrifugals and boiled back in the vacuum pan with fresh syrup ("mixed" or "second sugar").[21] The boiling in the vacuum pan proceeded to the grain or crystal formation point, and fresh syrup added to the pan would deposit more layers of sugar on the crystals. Hence these sugars were also known as "grain" sugars. The bulk of Laurel Valley's output of sugars consisted of plantation granulated, in both first and second sugar forms.[22] To sell at the market price these sugars had to show a purity of at least $96^{\circ}$, with sugars of higher purity being preferred. Buyers of the brown or yellow product largely consisted of grocers, who then sold it for direct consumption.

Raw sugars were produced from the molasses left over after plantation granulateds had been manufactured. The molasses was boiled in the pan but only to "string proof" so that crystallization occurred outside of the vacuum pan in tanks or in hotroom cars. Hence these sugars were also referred to as "string" or "tank" sugars. Sugar from the first batch of molasses boiled back in the pan was known as "second" sugar, while any sugar prepared from molasses obtained in drying this sugar in the centrifugals, was known as "third" sugar. The decision to make third sugars was not automatic but was based on careful consideration of the market value of molasses as opposed to that of third sugar. Thus in 1907 Lepine asked the Barker Company in New Orleans to "kindly advise me what molasses are worth as I intend drying seconds and do not know if I should make it in thirds."[23] The raw sugars manufactured at Laurel Valley formed a lower segment of total sales than did plantation granulated. These soft brown sugars with their small crystals and purities ranging from 80° to about 90°, were sold primarily to refineries where they were processed into the familiar white sugars used for general consumption. Few plantations in Louisiana had the capacity to refine these raw sugars in their own sugarhouses.

Molasses, the final item produced at Laurel Valley, formed a segment of sugar sales smaller still than raw sugars accounted for. This was because most of the molasses on hand was used to form the raw sugars. Still, the plantation generally sold several thousand dollars' worth of molasses, both first and second (second molasses being available only when third sugars were not made), to refiners. The refiners usually mixed this product with corn syrup before selling it.[24]

While the firm of Barker and Lepine continued to manufacture sugars of good quality after it ended the period of substantial growth in the Sugarhouse after 1910, it found itself struggling to stay in business because of other factors. A flood in the spring and early summer of 1912 destroyed the cane crop standing in the fields, so that no sugar could be manufactured and sold in the following season. At one point the prospects for the plantation appeared so bleak that Lepine asked a cotton planter for advice on how to begin a cotton plantation, telling him that "We are sugar planters and it looks as though we will have to get out of this business."[25]

The firm persevered, however, and despite another terrible year in 1915 when the sugar produced amounted to only 2,500,000 pounds and barely $156,000 in sales[26], Laurel Valley Plantation moved through the prewar and war years in fairly good health. The end loomed near, however. Unbeknownst to most planters in Louisiana and most of the sugar region in the South, the cane mosaic disease had begun infesting cane fields after 1913. It produced symptoms visible little, if at all, but the canes were left weakened and open to infections from other diseases as a result of being infected by the mosaic disease.[27] The full effects of the cane mosaic disease began to be felt in the industry just as prices for sugar reached their highest point ever on the Sugar Exchange. Many planters, Lepine included, made sugar from the prime canes in their crop, leaving poorer canes in the field where they quickly fell prey to the mosaic disease.[28]

The result was tragic for Laurel Valley. From 1919 to 1926 the cane crop averaged less than half of what it had been from 1899 to 1918.[29] Burdened with rising costs and growing debts, Lepine began to experience extended periods of ill health. In 1926 the man who had managed Laurel Valley for 34 years died in early January. A report prepared on plantation conditions a month later painted a gloomy picture of Laurel Valley, noting that its seed cane was "of very poor quality" and adding that two nearby plantation sugarhouses were closing their doors.[30] After another dismal season, Laurel Valley Sugarhouse joined them as it ceased operations once and for all. Although Mr. Lepine's son hoped to carry on the business and re-open the sugar factory, his plans were stymied by the outbreak of the Great Depression in 1929.[31]

## Notes To Section Two

Abbrevations used in this section :

- BL Barker and Lepine, Laurel Valley Plantation
- JWL J. Wilson Lepine
- LVC Laurel Valley Collection, Nicholls State University Library Archives, Thibodaux, Louisiana
- TSP Joseph W. Tucker Succession Papers, No. 230 Probates, Lafourche Parish Courthouse, Thibodaux, Louisiana

1

Further details on Joseph Tucker and on Laurel Valley Plantation during the antebellum era may be found in Leslie, pps. 5-13. The information presented in this report on the antebellum era at Laurel Valley is largely drawn from Dr. Leslie's account.

2

Leslie, p. 13.

3

Petition of Louis Bush, 1872, TSP.

4

Tenant lease contract, 1868, TSP.

5

Invoice for Gossin's Store, 1867, TSP.

6

Petition of Louis Bush, 1872, TSP.

7

Invoice for Daniel and Jas. Edwards, n.d., TSP.

8

Statement of the Sugar and Rice Crops made in Louisiana, Louis and Alice Bouchereau, comps., 1874-1877 edition.

9

Lafourche Court, 19 January 1893.

10

" Statement made by J.W. Lepine of the firm of Barker and Lepine," 18 January 1910, Item 255 (Letters Sent, 1910), LVC.

11

" Honorable Frank Barker," in " Lafourche Parish Edition," The Southern Manufacturer, 5:7 (November 1901), p. 53. Barker died in 1903 in New Orleans. Lepine continued his association with the Barker Company in New Orleans.

12 Further information on the Laurel Valley Railroad will be found in Rumm, "Laurel Valley Railroad."

13 BL to A.S. Cameron Steam Pump Works, New York, 28 December 1900, Item 249 (Letterbook, November 1899 - January 1901), LVC.

14 Lafourche Comet, 16 November 1893.

15 "Laurel Valley Plantation," in "Lafourche Parish Edition," The Southern Manufacturer, 5:7 (November 1901), pp. 52-53.

16 BL to Aug Salaun Insurance Agency, New Orleans, 4 August 1916 Item 261 (Letters Sent, 1914), LVC.

17 Spencer, p. 141.

18 Ibid. , pp. 142-43.

19 George M. Rolph, Something About Sugar, pp. 41-42.

20 Ibid.

21 Stubbs, p. 675. The situation is somewhat confused in the case of Laurel Valley, for the income and expense statements of the Sugarhouse list sugar sales as first, second, or third, without making any distinction, in second sugar, between plantation granulated and raw second sugar. The diaries, however, show that both types of sugar were being manufactured at Laurel Valley. In 1907, for example, both granulated seconds and "straight firsts" were produced. (LVD, 1907, 3 November.) Other entries, especially from December and January, describe the manufacture of raw second sugars.

22 Income and expense statements for Laurel Valley Plantation, 1901 - 1915, chart in Leslie, following p. 25.

23 JWL to the Frank Barker Company, New Orleans, 5 November 1907, Item 253 (Letterbook, July 1906 - June 1908), LVC.

24 Stubbs, p. 677.

25 JWL to C.C. Cannon, Cheneyville, Louisiana, 10 January 1914, Item 259 (Letters Sent), LVC.

26 "Sugar Cane Production - Mills," chart in Leslie, following p. 25. The low volume of sugar sales recorded for the year may have been due to the decision of the American Refining Company to withdraw from the Sugar Exchange over a dispute with planters concerning prices for raw sugar. The result was that many planters had to sell their raw sugars at "sacrifice prices." (Sitterson, p. 352.)

27 Sitterson, p. 346.

28 Leslie, p. 18.

29 Ibid.

30 [?] to Morris Le Compte, New Orleans, 28 February 1926 (Miscellaneous Papers), LVC.

31 Letter of J. Wilson Lepine, Jr., quoted in "Laurel Valley Plantation," National Register of Historic Places Inventory - Nomination Form, prepared by Paul Leslie, Anne Harmon, Mina McKee, et. al.

## III. THE MANUFACTURE OF SUGAR AT LAUREL VALLEY SUGARHOUSE IN THE BARKER-LEPINE ERA

Laurel Valley's greatest significance arises from its years of sugar production during the twentieth century. Many accounts have been written of typical Louisiana sugar plantations and their operations during the nineteenth century. Few authors, however, have considered a post-1900 plantation which has reaped the fruits of the prior century's inventive spirit. The manufacture of sugar changed dramatically during the antebellum years, as has been noted previously, but few have described the operation of a plantation sugarhouse which employed the newer methods of producing sugar. Laurel Valley offers the opportunity to shed some light on this area.

Our most immediate source of information, the sugarhouse, has, however, been reduced to ruins by Hurricane Betsy in 1965. The Historic American Engineering Record study of Laurel Valley Plantation has resulted in the production of drawings which indicate how the building may have looked before this event. Few pieces of equipment, however, have remained to the present day. The major pieces include a set of 6 Weston centrifugals, a screw conveyor and bucket elevator, 4 large magma tanks, 3 bagasse furnaces, and a dynamo. Several of these were largely inaccessible to study because of the debris which covered them.

In order to gain a tentative understanding of the operations of the sugarhouse during the Barker-Lepine era, therefore, we must rely primarily on the written record. Fortunately a large body of records from the plantation have been preserved, including correspondence, business and account papers, diaries, equipment inventories, and blueprints. Using these materials, along with contemporary accounts of other plantations and technical handbooks on sugar manufacturing, we can describe the sugarhouse as it operated in the Barker-Lepine period.[1]

"Grinding preparations everywhere. Greasing cars, cleaning House, etc. etc."[2]

This entry from the 1903 plantation diary suggests one aspect of sugar production which had changed little since 1795. The grinding start marked the beginning of another year of sugar production, and on every plantation there was a great rush in the last few weeks before grinding to get everything ready to begin. "The sugarhouse is thoroughly examined," wrote T. B. Thorpe in 1853, "and each ramification, or department, undergoes a rigid scrutiny."[3] It was the same state of affairs at Laurel Valley. The month of October marked a time of great activity as engineers repaired equipment in the sugarhouse, field hands gathered ratoon canes to be planted for next year's crop, and itinerant laborers arrived from Mississippi and other areas to work in the factory during grinding.[4]

Grinding gave life to the sugarhouse, for it was in this critical operation that the precious juice of the harvested canes was released for making sugar. The juice-cells of the thick hard stalks would yield their juice only when the canes were subjected to extreme pressure from the crusher and the mills.

The crusher prepared the stalks for milling by splitting them.[5] The two horizontal rolls on the crusher cut deeply into the cane with a set of zigzag teeth known as "disintegrators." Their cutting shredded the stalks into a pulpy mass. Juice from the canes flowed into a juice-pan beneath the crusher and was directed into an elevator lined with brass screens. These removed fibers and larger particles from the juice as it flowed from the juice-pan into a large wooden tank beside the mill train.[6]

A bagasse carrier, much like the older cane carrier described in Section One, delivered the cane from the crusher to the first of the two mills. This first mill exerted the greatest pressure upon the cane as it passed between the massive rolls.[7] Again, juice flowed from the canes as the grooved mill rolls cut into the mass, the juice flowing through these grooves and into a juice-pan below the mill. A second juice elevator located midway between the first and second mills discharged the juice into the juice tank.[8] Jets of water sprayed on the bagasse as it exited from the first mill helped to wash out any juice and to soften the canes further before they reached the second mill.[9]

The massiveness of the mills hid the fact that grinding was a delicate operation. Variations in the sizes of the canes or in the amount of canes passing through the mill could damage the mill if some flexibility were not allowed. Thus the top mill roll "floated" in its housing and rose or fell with variations in the cane. Hand-powered hydraulic rams also were used to regulate the pressure upon the top roll.[10] These rams also enabled the mill operator to raise the top roll if a stray piece of metal entered the mill. Despite these measures, accidents still often marred the grinding. In 1903, for example, the diary noted a"clear straight run until 3 am of Novb. 3rd"

> when several stud-bolts of the false-flanges of the Back-Mill Top-Roller gave away and broke clear

> away, this caused the bagasse to jam up against the side-blade and create a general wreck and mess.[11]

This accident forced a stoppage of the grinding operation until repairs could be effected the following day. In most cases, however, the accidents did not produce serious damage to the mills.

In its wooden juice tank the juice was allowed to settle as particulate materials in it precipitated out. After this it passed to an adjacent wooden tank where sulphuration took place. Sulphur dioxide fumes from a sulphur-burning cast iron stove passed through a cooler and then entered the wooden tank as a mixer agitated the juice to expose all of it to the bleaching action of the gas.[12]

Another treatment followed, the juice having been pumped to one of three large liming-tanks on the second floor of the sugarhouse. Liming the juice with "sugar lime" (limewater) precipitated gummy matter out of the juice and neutralized its acidity.[13] The impurities settled to the bottom of the tank, from which they were discharged.

The juice was now ready to be clarified. The process of clarification, in which the juice was heated to produce a thinner and lighter-colored juice free of most of its impurities, took place until 1911 in Laurel Valley Sugarhouse in open tanks and evaporating pans. Six round tanks fitted with steam pipes first heated the juice to boiling and a thick scum of impurities formed on its surface. As this scum was removed, using wooden "sugar paddles," the juice continued to boil briskly until the release of its impurities largely subsided. It then ran into several large open syrup tanks on the first floor for settling. Finally the syrup was pumped back to the second floor to a set of shallow evaporating pans fitted with copper coils. Here the syrup again boiled as it was brushed with ladles to remove any scums that rose to the surface.[14]

Lepine acquired a new clarifaction system, the Demings system, for the sugarhouse in 1911.[15] This system had been developed in England for clarifying sorghum sugars, but after 1890 it began appearing in cane sugar factories. Its use began to supercede the use of open evaporators for clarifying, since it provided better economy of steam, labor, and space in the sugarhouse.[16] The Demings system consisted of three units: the eliminator, the heater, and the settling-tanks. A contemporary handbook described the operation of the eliminator and superheater in an early 20th century factory:

> The juice is limed in the cold . . . in a single constant flow tank. Milk of lime flows into the juice at the heater-pump intake and is thoroughly mixed with it in the pump and in transit to the heaters. The limed juice is heated to approximately 235°F. and is then passed into an eliminator, where it parts with the gases, is slightly concentrated, and warms the incoming juice on its way to the heater. The eliminator is a cylindrical closed-iron-vessel with a conical bottom and is provided with a large heating-surface in copper tubes. Cold juice circulates through the tubes and condenses the steam set free when the hot juice enters the lower section of the eliminator. A partial vacuum is produced by this condensation and the air and other gases are withdrawn from the hot juice.[17]

The juice was then conveyed through a pipe to one of the Demings settling tanks, which were formed of steel and

> made in the form of truncated cones with conical bottoms, the small diameter of the tank being at the top. Suspended in the center is a vertical cylinder somewhat less in diameter than the upper part of the tank. This cylinder extends downward about eight feet to a point opposite the largest diameter, which makes the area between the circumference of the suspended cylinder and the tank at that point very much greater than the area of the cylinder itself. This difference in area is necessary to retard the flow of the juice and allow the sediment, mud and insoluble solids to be deposited at the bottom of the tank.[18]

The juice entered the vertical cylinder and flowed slowly down to its bottom edge; here its movement was slowed even further as it turned upward upon emerging from the cylinder. It exited through a pipe connected to the side of the settling-tank below its upper rim. The sediments and mud in the meantime settled to the bottom of the tank from where they were continuously discharged.[19]

While the brownish juice, now clarified, went to the evaporating room to be boiled into syrup, the mud and sediments, which still contained some usable juice, went to the filter-press room on the second floor of the sugarhouse. The filter-press consisted of a horizontal arrangement of corrugated iron plates and hollow frames held in a heavy framework. Canvas filters stretched over the hollow frames formed a joint between the plates and the frames. The mud and sediments passed under pressure through inlet channels into the assembly. In their passage they accumulated on the canvas sheets, while clear juice passed through the sheets, down the corrugated face of the plates, and out of the press through small holes in the plates. It then joined the clarified juice in the evaporating room.[20]

The canvas filters were removed from the press and washed in a washing machine to remove any sugar remaining in the sediments. Any sugar recovered was also sent to the evaporating room. The mud was then collected in "slop tanks" for use in the cane fields as fertilizer.[21]

Because the juice at this point contained 85 percent water and 15 percent solid matter at this point, it had to have most of this water removed in order for syrup to remain. This evaporation occurred in the double effect on the second floor of the sugarhouse.

The operation of the multiple effect has been described in

Section One and need only be summarized here. Juice entered the first vessel of the double effect in which a slight vacuum was maintained by the vacuum pump. Exhaust steam heated the juice to boiling at a temperature somewhat below its normal boiling-point. The steam released from the boiling juice passed through a vapor-pipe into the calandria, the heating-chamber, of the second vessel, and the juice from the first vessel was forced into this body when the vacuum pump produced a pressure in it lower than that in the first body. The juice, cooler than the steam, condensed the steam in the calandria, and the heat released by this conversion caused the juice to boil again at a lower temperature than in the first body. When it emerged from the effect at the end of this boiling, the juice had been condensed into a syrup containing only 35 percent water and 65 percent solid materials.[22]

From the double effect the syrup went to a set of receiving tanks in which the balance of the solid material it contained was allowed to settle. Most of this material had existed as soluble matter in the juice, but in the heat of boiling and evaporation it became insoluble matter in the syrup. In order to prevent impurities from injuring the sugar, therefore, the syrup came to these settling-tanks.[23]

The double effect at Laurel Valley Sugarhouse, described by its manufacturer, John H. Murphy of New Orleans as "a Double Effect Evaporating Apparatus with Overflow, Condenser and Accessories for Plantation Sugar House Work," was installed about 1895.[24] The accessories referred to included eyeglass frames permitting the double effect operator to inspect the syrup, a syrup tester, a pressure vacuum gauge, a brass thermometer, and piping for the juice, sweetwater, and condensate flows.[25] A charge tank next to the first vessel of the effect continually replenished it with juice during evaporation, and "a constant level of the boiling liquid" was maintained in each vessel, "the juice being drawn from one vessel to the next by increasing vacuum."[26]

When prime grades of molasses were manufactured at Laurel Valley, a set of evaporating pans was employed to boil the syrup to a greater density before it went to the settling-tanks. As the syrup boiled in these pans, it was brushed by tenders using ladles as insoluble material formed a scum on its surface. According to other plantations which also did so, this re-boiling imparted a better flavor and a purer color to the syrup because of the removal of its impurities.[27]

From the settling-tanks the syrup went to the vacuum pan in which it was fully concentrated to form sugar. The vacuum pan operated much like a single vessel of the double effect; syrup was boiled in a partial vacuum below the temperature which would have been required if it were boiled in open pans. Steam passing through coils in the pan heated the syrup to boiling. A condenser removed water given off from condensing steam during the boiling.

Two pans were employed at Laurel Valley, a 7 foot and a 10 foot pan. The larger of the two pans was probably used primarily to manufacture raw sugars. According to one handbook, larger pans were preferred for making these softer sugars since the syrup was not allowed to reach its granulation point when forming this product. Larger pans had large heating-surfaces and operated under a very low pressure so that the syrup boiled at a temperature maintained as low as possible to prevent grain formation.[28]

The process of manufacturing plantation granulated sugars began with the delivery of a charge of syrup to the vacuum pan. The vacuum pump reduced the pressure in the pan and steam entered the coils, causing the syrup to boil. As the syrup concentrated it became a mass of sugar approaching its saturation level. When this saturation point was reached, tiny crystals or grains of sugar began to appear in the mass -- hence the alternate name of "grain sugar" for this product.

The formation of the grains was the signal to the sugar boiler to inject a fresh charge of syrup into the pan. If he added this fresh syrup too late, allowing the syrup surrounding the grains in the pan to become supersaturated with sugar, "false grains" would form when the fresh syrup was put into the pan. If these appeared they had to be melted down in the pan, for their presence in the strike of sugar from the pan would prevent the sugar from purging its molasses properly in the centrifugals.[29] Presuming the syrup was added correctly, it would deposit layers of sugar upon the grains already present in the pan, rather than form new crystals.

The process of charging the pan with fresh syrup to add more layers of sugar to the grains continued, with progressively smaller amounts of syrup being added in each charge. As the strike-point approached, the sugar boiler reduced the heat in the pan to slow down the layering process. When he determined that the proper amount and size of crystallization had taken place, he shut the steam flow off to the pan altogether to let the mass of grains and crystals ("massecuite") cool. At the moment of striking, when the massecuite was discharged from the pan, it had cooled as far as possible.[30]

The amount of time required to bring a pan of syrup to the strike-point at Laurel Valley Sugarhouse varied with the quality of the juice from which the syrup had been derived. Lepine told one planter that

> Here it takes us nine to ten hours and we get 35 to 30,000 pounds sugar to the strike. The pan is in first class order and is working well but slow. I suppose that the juice makes it so slow in boiling, by being green.[31]

Syrup obtained from juice later in the season, however, took much longer to reach its strike-point because poorer grades of cane and canes affected by cold weather and frost were being ground to obtain juice. "The juice is getting worse and it takes 11 hours to boil one strike," reported an entry in the plantation diary for mid-December 1911.[32] Juice from the final days of grinding, in late December and early January, often formed syrup which "did not yield hardly any" sugar in the pan.[33]

The massecuite, which had the consistency of half-melted ice, flowed sluggishly from a door beneath the vacuum pan as it was discharged into a steel trough leading to the centrifugals. Workers pushed it along using wooden sugar paddles. Before it entered the centrifugals the massecuite was stirred in a mixer, a long tank mounted above the centrifugal baskets which agitated the mass using wooden beaters. This stirring and agitating prevented the massecuite from hardening to the point where it could not be worked in the centrifugals.[34]

A set of six centrifugals (the set which survives in the factory ruins) worked the mass of crystals and syrup from the 7 foot pan. Valves in the mixer opened, releasing enough of the mass into each basket to almost fill it, and a small amount of syrup was added to form a slurry in the basket when it spun. The centrifugal basket spun on its spindle at some 260 revolutions per minute[35], the slurry of syrup, molasses, and crystals separating as it revolved. The syrup and molasses were forced out through the screen in the basket, leaving behind the fine moist crystals of sugar. Water sprayed on these crystals removed the film of molasses surrounding each crystal, so that at the end of the purging operation each crystal had become brownish-yellow in color.[36]

The crystals were scooped out of the centrifugal with paddles into a trough in which a screw conveyor turned. This prevented the grains from adhering together into lumps of sugar. The conveyor delivered the sugar to an elevator consisting of several small metal buckets, and this elevator lifted the sugar up to the third floor of the sugarhouse. From here the sugar fell into one of the granulators, a long drum which tilted from top to bottom as it rotated. Longitudinal shelves in the drum lifted the sugar and tumbled it as a blast of warm air from a fan passed through the chamber. This action dried the last of the moisture from the sugar, so that hard fine crystals remained.[37]

The bucket elevator then delivered the sugar to the first floor where it fell into a set of sugar shakers. These bins rocked from side to side to break up any lumps which had lasted through the granulators. Before it was packed the sugar's net weight was recorded, a sample was removed, and its sucrose content was noted in the laboratory as a means of quality control of the product. This was crucial since, as has been noted, sugar sales depended primarily upon the color and purity of the product.[38] The sugar was then packed into sacks of 125 lbs. each, the sack having been stamped with "Laurel Valley Plantation Granulated Sugar." It was loaded onto waiting railroad cars for shipment to market or was stored in a warehouse at Melodia Switch on Melodia Plantation.

The molasses which had been purged from the first sugars went to tanks for storage. After the seasonal yield of first sugar had been manufactured, the first molasses was used to form more plantation granulated sugar.[39] It was pumped to the vacuum pan and mixed with a charge of fresh syrup.[40] The boiling process proceeded as in the manufacture of first sugar, the "mixed massecuite" which resulted being conveyed to the mixer, the centrifugals, and the granulators. It produced a sugar equal to the first run of plantation granulated in purity, although since it contained more molasses, its color was a deeper brown. In 1907, the sugarhouse "obtained an average of 104 2/3 lbs. sugar to the ton /of cane/ including granulated seconds; 91 lbs. straight firsts."[41]

Again, the purged molasses from this sugar run were used to make sugars by boiling back, especially when the sugarhouse became "too crowded and the molasses tanks mostly all full."[42] In this case, however, the proceedure varied considerably, for molasses from mixed sugars were used to make "string" rather than grain sugars. The mixture of molasses and syrup (or the molasses alone) was boiled in the large vacuum pan after the molasses had been melted in a sugar melter to remove any crystals of sugar.[43] In the pan the syrup boiled not to graining but "to such a density that when a small portion of it is drawn between the thumb and fore-finger it will string out into a fine thread before breaking" -- hence the term "string sugar."[44] After boiling and discharge from the pan, the strike did not go to the centrifugal but into either small metal wagons or into large magma or "crystallizer" tanks. The sugar wagons were housed in a room on the second floor of the factory in which pipes had been placed so that exhaust heat from the engines would maintain the room at a constant temperature of 110° F. Sugar grains formed in these wagons in the heated room, and after a few days the mass in each wagon was delivered to the battery of four centrifugals adjacent to the hotroom and purged of its molasses. The molasses was then piped to large storage tanks.[45]

Sugar in the crystallizer tanks formed much more slowly since the mass of molasses was allowed to cool in an undisturbed state for several months. During this period of time small soft crystals of raw sugar formed on the top layers of the mass and drifted slowly to the bottom of the tank. Many sugar manufacturers condemned the use of tanks to form sugar; as one wrote, the tanks

> resulted in a small and irregular grain, due to local oversaturization consequent on the lack of any circulation in mixing; much of the fine grain so formed was therefore lost with the molasses since it passed through the gauzes in the centrifugals.[46]

Lepine, however, saw no harm in this method, as he told Frank Barker:

> Regarding your inquiry about second sugar, would say that I do not think sugar will lose in the tanks especially not if it should be soft, as in that case it would be sure to gain.[47]

The string sugar remained in the tanks until late spring. Working with spades and paddles, the sugar-driers removed the sugar from the tank when ready and placed it in the hotroom to let it crystallize for a few days at warmer temperatures. After this the sugar was dried in the centrifugals. The granulators were normally not used when raw sugars were produced since the product was sold to refiners for processing rather than to markets for direct consumption.[48]

The molasses derived from the purging and drying of the string sugar was either sold in its current condition to refiners, or, if prices for molasses were low, it was manufactured into third sugars as has been noted in Section Two. Again the product was formed by boiling back molasses and allowing the mass to crystallize quickly in hotroom cars or slowly in crystallizer tanks. The "blackstrap" molasses which resulted when the third massecuite was purged, was storedin tanks in the sugarhouse and pumped into railroad tank cars when sold.[49] If molasses from string sugars was not made into third sugar, it was packed in 50 gallon barrels, furnished by the purchaser or made in the plantation coopershop at Laurel Valley.[50]

The steam used to drive engines and pumps, and to boil juice into syrup and syrup into massecuite, was produced by boilers which relied, in part, on the bagasse from the crushed cane for fueling their furnaces. This matter, emerging from the second mill in a fairly dry state, passed along a conveyor from the mill room to the boilerhouse. Chutes along the bagasse carrier dropped the cane trash into the furnaces, upon which had been placed a series of grate-bars.[51] "A modern sugar mill," wrote one expert,"requires practically no other fuel than that obtained as a by-product from the crushing of the cane."[52]

This held true at Laurel Valley until the late 1890's, when Barker and Lepine installed an electric light plant in their sugarhouse. The amount of bagasse obtained from the grinding process was insufficient to furnish fuel for the boilers which would power this plant, and therefore Lepine installed a set of boilers equipped with oil-burning furnaces.[53]

Another requirement for the boilers in the factory was water for steam. This need was answered by a pumping station at Bayou Lafourche near the entrance to the plantation. The pump delivered water from the bayou through a pipe to a pond behind the sugarhouse.[54] In 1906 this reservoir was enlarged, the diary noting that "the boilers are so mean that the double effects and pan cannot use the steam necessary." A new pump was installed at the bayou the following year. It delivered water through a 10 inch suction pipe and was driven by a 15 horsepower gasoline engine.[55]

The pond to the east of the sugarhouse served as a receptacle for sweetwater drawn off from the double effect and the vacuum pans. A pipe carried water from the sugarhouse to the pond.[56]

The final item worthy of mention in Laurel Valley Sugarhouse was its fire prevention system. Lepine was deeply concerned about the danger of a fire to his factory. In 1907 he installed a complete fire prevention system, the main unit of which was a 77 foot high outside water tank which held 24,000 gallons of water. He described other elements of the system to the Louisiana Fire Prevention Bureau:

> We have 12 - 2 inch hose connections inside instead of 9, all connected and nozzles attached; we have 8 private hydrants, 2-way, around the sugarhouse and 3 private hydrants 2-way in quarters. We also have spittoons and no cigarette smoking allowed in the building.[57]

Lepine often acted as his own policeman in enforcing this regulation; on more than one occasion he immediately discharged a worker found smoking in the factory.

## Notes to Section Three

Abbrevations used in this section:

BL Barker & Lepine, Laurel Valley Plantation
JWL J. Wilson Lepine
LVC Laurel Valley Collection, Nicholls State University Library Archives, Thibodaux, Louisiana
LVD Laurel Valley Diary, Laurel Valley Collection

1 Information on two topics, the cultivation of sugar at Laurel Valley and the formation of a plantation work force, will be found in Leslie, "Laurel Valley Sugar Plantation." The topic of delivering harvested cane to the mill is treated in Rumm, "Laurel Valley Railroad."

2 LVD, 1903 (24 October).

3 Thorpe, p. 760.

4 Laurel Valley Diaries, 1903-1904, 1906-1915, entries for October.

5 Spencer, p. 10.

6 "Specifications of 34" X 78" six-roller mill and gearing and 26" X 78" crusher ...," 1905, Item 10 (Miscellaneous Items), LVC. The removal of cane fibers from the juice was important, since it contained a substance, sacharetin, which formed a black compound when it came into contact with iron. This compound, if formed, spoiled the juice. (Spencer, pp. 6-7).

7 Spencer, p. 21.

8 "Specifications of 34" X 78" six-roller mill," LVC.

9 Spencer, p. 19.

10 *Ibid.*, p. 17.

11 LVD, 1903 (2 November).

12 Llewellyn Jones and Frederic I. Scard, The Manufacture of Cane Sugar revised edition, p. 102.

13 Noel Deerr, Cane Sugar, p. 246.; Spencer, p. 72.

14 Spencer, pp. 47-48.

15 LVD, 1911 (8 April; 29 August; 1 September).

16 H.C.P. Geerligs, Cane Sugar and Its Manufacture, p. 137; Spencer, pp. 46-47.

17 Spencer, pp. 45-46.

18 George M. Rolph, Something About Sugar, p. 26.

19 Ibid.

20 Ibid., p. 27; Spencer, pp. 66-67.

21 Rolph, p. 27; LVD (23 September), 1914 (1 July).

22 Rolph, p. 29.

23 Spencer, pp. 80-81.

24 John M. Murphy Trade Catalog, 1895-96 (Uncataloged Items), LVC.

25 Specifications for repairs to double effect, John H. Murphy and Sons, 30 April 1920 (Uncataloged Items), LVC.

26

Rolph, p. 29; LVD, 1910 (16 November), 1914 (25 May).

27

_Gilmore's Directory of Louisiana Sugar Planters_, A.B. Gilmore, comp., 1925-6 edition, p. 74; Spencer, pp. 80-81.

28

Spencer, pp. 90-91.

29

_Ibid._, pp. 87-88.

30

_Ibid._, p. 87.

31

JWL to William Dill, New Orleans, 26 November 1909, Item 254 (Letter Book, July 1908-- September 1909), LVC.

32

LVD, 1910 (10 December).

33

LVD, 1912 (2 January).

34

Rolph, p. 33.

35

BL to the Commercial Electric Company, New Orleans, 20 October 1903, Item 251 (Letterbook, June 1903--August 1905), LVC. Sugar handbooks placed this figure at 1000 to 1500 RPM's. (Rolph, p. 33; Deerr, _Cane Sugar_, p. 372.).

36

Stubbs, p. 674.

37

Spencer, pp. 110-111; Stubbs, p. 675.

38

Rolph, p. 34.

39

LVD, 1903 (16 November); 1906 (18 December).

40

Spencer, pp. 90-91; Stubbs, p. 675; LVD, 1915 (16 November).

41

LVD, 1907 (3 November).

42
LVD, 1906 (15 December).

43
Spencer, p. 93.

44
Stubbs, p. 675; LVD, 1912 (2 January).

45
Spencer, pp. 70-82; LVD, 1912 (25 January).

46
G.H. Jenkins, Introduction to Cane Sugar Technology, p. 348.

47
JWL to Frank Barker, 18 December 1900, Item 249 (Letterbook, November 1899-- January 1901).

48
Stubbs, p. 675.

49
*Ibid.*, LVD, 1908( 12 June; 24 June; 4 August).

50
LVD, 1904 (4 June); 1907 (4 February).

51
Rolph, p. 24; LVD, 1915 (14 October).

52
Rolph, p. 24.

53
Inventory of Laurel Valley Plantation, prepared by George M. Borde, 1919, LVC.

54
LVD, 1907 (22 January).

55
LVD, 1906 (29 November).

56
LVD, 1906 (1 October; 2 October); 1907 (11 September).

57
JWL to the Louisiana Fire Prevention Bureau, New Orleans, 11 June 1906, Item 252 (Letterbook, August 1905--July 1906).

# BIBLIOGRAPHY

I. Manuscript Collections and Personal Papers:

Louisiana State University Archives
Louisiana Sugar Planters' Association Papers

Nicholls State University Library, Thibodaux, Louisiana
Laurel Valley Collection:
Letter Books, 1899-1909
Time Books, 1901-1906
Log Book, 1908
Ledgers, 1903-1916
Diaries, 1903-1904, 1906-1915
Business and personal correspondence, 1909-1917
Invoices and drafts, 1903-1916
Inventories:
"Inventory of Laurel Valley Plantation, Barker and Lepine, Lafourche Crossing, Louisiana," Milwaukee, Wisconsin, 1909. Includes four blueprint sheets (factory area site plan, plans, sections elevations of sugarhouse and related structures). Also includes Monthly Change Sheet (1910) reflecting changes in sugarhouse after inventory.
Sugar House Equipment, section in "Inventory of Laurel Valley Sugar Plantation," prepared by George U. Borde, New Orleans, 1919. Includes 3 blueprint sheets (first, second, third floor sugarhouse plans).
Photographs:
Sugarhouse, Laurel Valley buildings, laborers
Uncataloged materials, retrieved 1978:
Business correspondence, 1918-1925
Annual summaries of expenditures and improvements, 1901-1912
Miscellaneous papers and records

II. Court Records:

Lafourche Parish Courthouse, Thibodaux, Louisiana
Clerk of Courts, Joseph W. Tucker Succession Papers, No. 230 Probates

III. Materials Pertaining to Laurel Valley Plantation:

"Honorable Frank Barker," The Southern Manufacturer, Lafourche Parish Edition, 7:7 (November, 1901), p. 53.

"Laurel Valley Plantation," National Register of Historic Places Inventory -- Nomination Form, Paul Leslie, Anna Harmon, Mina McKee, et. al., comps., (Thibodaux, Louisiana, 1977).

"Laurel Valley Plantation," The Southern Manufacturer, Lafourche Parish Edition, 7:7 (November, 1901), pp. 52-53.

Leslie, Paul, "Laurel Valley Sugar Plantation," paper for 1978 Laurel Valley Survey (Washington: United States Department of the Interior, Historic American Engineering Record, 1978).

Rumm, John C., "Laurel Valley Railroad," paper for 1978 Laurel Valley Survey (Washington: United States Department of the Interior, Historic American Engineering Record, 1979).

Stubbs, John, "Laurel Valley Village of Laurel Valley Plantation" (Thibodaux, Louisiana, 1975).

IV. Materials Pertaining to the Louisiana Sugar Industry:

"American Patents Which Issued in December, 1846," No. 12 (" For Improvements in the Apparatus for Heating, Evaporating, and Refining Liquids, specially intended for the manufacture of Sugar"), Journal of the Franklin Institute, 3rd Series, Vol. 15 (1848), p. 169.

"American Patents Which Issued in September, 1843," No. 33 ("Improvements in Sugar Works"), Journal of the Franklin Institute, 3rd Series, Vol. 18 (1849), pp. 478-479.

Benjamin, J.P., "Louisiana Sugar," De Bow's Review, 4 (1846), pp. 322-345.

Gilmore's Directory of Louisiana Sugar Planters for 1925-26, A.B. Gilmore, comp., (New Orleans, 1926).

"Improvements in Sugar," Journal of the Franklin Institute, 3rd Series, Vol. 19 (1850), pp 132-133.

"Manufacture of Sugar in Louisiana," DeBow's Review, 3 (1847), pp. 376-396.

Official Letter Books of W.C. Claiborne, 1801 -- 1816, Dunbar Roland, ed., (New York: AMS Press, 1972 reprint of 1917 edition).

Sitterson, J. Carlyle, Sugar Country: The Cane Sugar Industry in the South, 1753 -- 1910 (University of Kentuck Press, 1952).

Statement of the Sugar and Rice Crops Made in Louisiana, Alcee and Louis Bouchereau, comps., (New Orleans, 1868-1917).

Stübbs, W.C., " Origin and Evolution of the Sugar Industry of Louisiana," in Standard History of New Orleans, Louisiana, Henry Rightor, ed., (Chicago, 1900), pp. 646-687.

"Sugar-making in Louisiana," DeBow's Review, 5 (1848), pp. 285-293.

Thorpe, T.B., "Sugar and the Sugar Region of Louisiana," Harper's New Monthly Magazine, 7 (June-November, 1853), pp. 746-767.

V. Materials Pertaining to the Technology of Sugar:

Clarenc, J.F., "The Mechanical Side of Sugar Manufacture in Louisiana," International Sugar Journal, 17 (1915), pp. 424-427.

Classen, H., Beet Sugar Manufacture, William T. Hall and George W. Rolfe, trans., (New York: John Wiley & Sons, 1910).

Creighton, W.H.P., "Evaporating and Juice Heating," in Spencer (see below), pp. 350-381.

Deerr, Noel, Cane Sugar (New York: D. Van Nostrand Co., 1911).

Deerr, Noel, <u>The History of Sugar</u> (London: Chapman and Hall, 1950).

Geerligs, H.C.P., <u>Cane Sugar and its Manufacture</u> (Manchester, England: Norman Rodger, 1909).

<u>House Executive Documents</u>, 25th Congress, 3rd Session, II, No. 345, pp. 1-472 (Woodbury 1833 Census of Stationary Steam Engines in the United States).

Jenkins, G.H., <u>Introduction to Sugar Cane Technology</u> (Amsterdam: Elsevier Publishing Co., 1966).

Jones, Llewllyn and Frederic I. Scard, <u>The Manufacture of Cane Sugar</u>, rev. ed. (London: Duckworth & Co., 1921).

Mc Intosh, J.G., <u>The Technology of Sugar</u> (New York: D. Van Nostrand Co., 1903).

Pursell, Carroll W., <u>Early Stationary Steam Engines in America</u> (Washington: Smithsonian Institution Press, 1969).

Spencer, Guilford L., <u>A Handbook for Cane Sugar Manufacturers and Their Chemists</u>, 2nd edition (New York; John Wiley and Sons, 1917).

Rolph, George M., <u>Something About Sugar</u> (San Francisco: John J. Newbegin, 1917).

Spencer, Guilford L., <u>A Handbook for Cane Sugar Manufacturers and Their Chemists</u>, 2nd edition (New York: John Wiley and Sons, 1917).

Wik, Reynold M., <u>Steam Power on the American Farm</u> (Philadelphia: University of Pennsylvania Press, 1953).

VI. Newspapers:

<u>Lafourche Comet</u>, Thibodaux, Louisiana (1893).

# APPENDIX

Improvements made in sugarhouse, 1901 - 1910

American Appraisal Company, Appraisal of Laurel Valley Plantation, Lafourche Crossing, Louisiana, 1909

George U. Borde, Consulting Engineer, Inventory of Laurel Valley Plantation, 1919

"Laurel Valley Plantation," description in _Gilmore's 1925-26 Directory of Louisiana Sugar Planters_, A.B. Gilmore, comp.

## Improvements to Sugarhouse, 1901--1910

(Source: Annual Financial Statements,
Unless Otherwise Noted)

1901
electric plant
4 crown wheels
crusher housing
vacuum pump housing

1902
2 duplex pumps for oil burners
oil tank

1903
smokestack
sulphur machine
electric motor

1904
furnace for cooper shop for barrel making (Source: Diary)
cane loader (Source: Diary)

1905
mill crusher and feeder
sulphur outfit
heater
conveyor
pipe machine
fire extinguisher
1 lime pump
1 Williams Cane-Feeder

1906
Blake duplex pump
Blake sweetwater pump
waterworks for fire control

1907
separator for double effect
brass evaporator
2 slop tanks
19 #3 Wright steam traps
5 sugarhouse tanks (Source: Diary)
filter press washing machine (Source: Diary)

1908
cane loader
2 boilers 60" X 18'
1 boiler shed
2 magma tanks 25' X 12'

1909
American Hoist & Derrick Co. cane loader

1910
6 magma tanks
Davies Generator
liming tanks for juice (Source: Diary)

American Appraisal Company, Appraisal of Laurel Valley Plantation, Lafourche Crossing, Louisiana, 1909.

Building #1/A (Pump House)

1 Merrick & Son 12" steam and 2 - 22" water cylinders 36" stroke vertical fly wheel type steam walking beam vacuum pump - 108" flywheel.

1 Cameron 6 x 3 x 5 horizontal single steam pump - brass rod.

1 Cameron size 6 horizontal single steam pump #17048 - brass rod.

1 Knowles 8 x 5 x 12 horizontal single steam pump - #55423 - brass rod.

1 Guild & Garrison 12" x 18" x 24" horizontal single steam air compressor - #15446.

Building #2 (Cane Shed)

1 Williams (Thibodaux) power cane feeder - 7' x 26' wood frame - 13' 10-tooth rake with drums, chains, shafts, etc.

1 10 x 12 vertical center crank slide valve engine - 34" x 7" fly wheel - 24" x 10" pulley.

1 Birmingham Mach. & Fdry Co. 78" 2-roll crusher - rolls 26" dia. - solid - 13" journals - heavy duty bed plates - gear stands, etc. connected to
Birmingham Mach. & Fdry Co. 18 x 36 horizontal right hand Corliss engine - 16' fly wheel - Standard 2-strand cane carrier 158' centers - 2-3/4" x 35" cypress box, with wood supports, sills, and all wood work.
1 Jackson Church Co. (Saginaw, Mich.) 6 x 8 horizontal twin engine - drive for cane carrier.

5 Whitney Iron Works (New Orleans) 24" x 24" - 38 plate horizontal double screw filter presses.

1 4 x 7 horizontal slide valve engine - 6" x 6" pulley.

1 40" x 62" casing 34" x 50" cylinder all wood washing machine - reversed gear drive.

1 17" power wringer - 2 - 3" rubber rolls - 16" x 3" tight and loose pulley.

Building #3 (Mill)

1 Birmingham Mach. & Fdry. Co. (Birmingham, Ala.) 78" 6-roller mill - rolls 34" dia. heavy duty bed plates - gear stands, etc. - 15-3/4" journals, connected to

1 Birmingham Mach. & Fdry. Co. 26 x 54 horizontal left hand Corliss engine - 18' fly wheel - intermediate carriers and Standard bagasse carrier 25' centers.

2 Watson- Stillman Co. (New York) hand power hydraulic pumps, with accumulators, piping, etc. - 6000# on 12½" ram.

Building #4 (Double Effect House)

First Floor

1 Special Sulphurating system - 33" x 36" x 66" brick sulphur furnace, with cast iron goose neck connection to 24" x 9' cast iron condenser with pipe connection to 27" x 10'6" x 35" wood tank.

1 Geo. F. Blake 8 x 7 x 10 horizontal duplex steam pump - #155120 - brass rods.

1 Guild & Garrison 6 x 3½ x 6 horizontal single steam pump - brass rod.

1 Cameron size #3 horizontal single steam pump - #12082.

1 Deane Steam Pump Co. (Holyoke) 18 x 14 x 24 horizontal single steam pump #15504 - brass rod.

1 Geo. F. Blake 8 x 10 x 112 horizontal single fly wheel type steam pump #155194.

1 Geo. F. Blake 8 x 10 x 8 horizontal single fly wheel type steam pump #56527.

1 Geo. F. Blake 8 x 6 x 12 horizontal single steam pump #56387.

1 McGowan 6 x 6 x 6 horizontal single steam pump - brass rod.

1 Geo. F. Blake 5¼ x 3½ x 6 horizontal duplex steam pump - brass rods.

1 Geo. F. Blake 20 x 18 x 24 horizontal single steam pump #57356.

Second Floor

1 J.H. Murphy (New Orleans) 9' standard double effect, with catch-all condenser and all regular fittings.

1 7' dia. 30" deep copper evaporating pan - 14" flow at top with overflow - 2½" copper coil, with piping, etc.

Battery of TWO - 8' x 30" copper evaporating pans - 14" flow and overflow - 2½" copper coil.

6 10' dia. x 6'8" deep 1/8" iron clarifier tanks, with 5/8" x 2" iron rim - 2½" copper coil.

Building #5 (Pan House)

First Floor

1 Cameron size #11 horizontal single steam pump #170231.

1 Geo. F. Blake 12 x 18 x 10 horizontal duplex fly wheel type steam vacuum pump #56551-2.

1 A. S. Cameron 18 x 24 x 24 horizontal single fly wheel type steam vacuum pump #17020.

Battery of SIX - Weston 30" brass basket top drive centrifugals, with 8' x 30' agitator - on cast iron frame with shafting, etc.

2 McGowan 6 x 6 x 8 horizontal single steam pumps #6 - brass rods.

Third Floor

1 Birmingham Mach. & Fdry. Co. 10' Standard vacuum pan - 7 - 2" coils, with condenser, catch-all and regular fittings.

1 7'6" Standard vacuum pan - 4 - 2½" coils, with condenser, catch-all and regular fittings.

1 6' x 6' platform 2-lift freight elevator - belt driven - spur-geared, with countershaft.

Building #5/A (Sugar House)

First Floor

4 Baldwin speed shakers - 21" platform and 12" x 4" tight and loose pulleys.

Second Floor

2 Special belt driven ceiling fans - 4 - 16" wood wings - 10' - 1 15/16" shafting.

Building #6 (Tank House)

First Floor

1 Guild & Garrison 12 x 12 x 10 horizontal single steam pump.

Building #7 (Hot Room)

First Floor

Battery of FOUR - S. S. Hepworth 30" brass bucket top drive centrifugals, with 48" x 21' x 42" deep mixer with geared agitator - on cast iron frame, wuth shafting, gearing, etc.

1 A.& W. Denmead & Son (Baltimore, Md.) 10 x 24 horizontal left hand slide valve engine - 3" fly ball governor - 8' x 14" fly wheel - outboard bearing.

1 60" sugar melter, with geared agitator.

1 Special car puller - 8" x 8" cast iron drum on
6' 1-15/16" shafting
2 12" ball and socket single brace drop hangers
2 set collars
1 12" x 3" x 1¼" bevel gear driven by 8" pinion on
10' 1-15/16" shafting
2 12" ball and socket single brace drop hangers
2 set collars
2 10" x 6" steel split pulleys.

Building #9 (Sulphur House)

First Floor

1 Geo. F. Blake 5 x 3 x 12 horizontal single outside packed steam pump.

Power Plant

Building #1 (Boiler House)

First Floor

Battery of SEVEN - Grainger & Co. (Louisville, Ky.) 60" x 18' horizontal return tubular boilers, with 52 - 4" flues, half arch extension fronts, stationary grates, 32" x 8' steam drums each boiler and 20" x 12' mud drums each boiler and fitted with all regular fixtures, including brick settings, 62" x 66" - 1/8" steel breeching 66' long, tapering to 50" x 50" with cast iron clean out door.

2 Batteries of TWO each 60" x 22' horizontal return tubular boilers, with 20 - 6" flues, brick fronts, stationary grates, 36" x 11'3" steam and 24" x 14' mud drums to battery and fitted with all regular fixtures, including brick settings for burning bagasse, 34" x 12' - 1/8" steel breeching 20' long tapering to 46" x 36".

Battery of TWO - 60" x 22' horizontal return tubular boilers, with 20 - 6" flues, brick fronts, stationary grates, 36" x 11'3" steam and 24" x 14' mud drums to battery and fitted with all regular fixtures, including brick settings for burning bagasse, 3' x 12' steel breeching 28' long tapered to 54" x 42".

Battery of TWO - 60" x 18' horizontal return tubular boilers, with 40 - 4" flues, stationary grates, brick front with bagasse furnace, 3' x 12' steam and 20" x 16' mud drums and fitted with all regular fittings, including brick settings, 60" x 30" x 10' - 1/8" steel breeching.

1 24" x 56" vertical tubular boiler, fitted with all regular fixtures, including brick settings and 10" x 16' stack with elbow.

1 Wheeler Condenser & Engineering Co. (New York) 30" x 8' exhaust steam feed water heater - 1000 horse power - 6" pipeconnections.

1 42" x 26' - ¼" hot water receiver.

1 Cameron Steam Pump Works 6 x 4 x 7 horizontal single steam oil feed pump - #17001 - brass rod.

2 Knowles 4½ x 2-3/4 x 4 horizontal duplex steam oil feed pumps - #108417-18 - brass rods.

1 Buffalo Forge Co.#11 cupola and forge blower - double drive, with countershaft and 7' - 15" iron pipe, 1 - 15" x 10" Y branch, 8' - 10" galv. iron pipe, 2 - 10" malleable gates.

1 Champion Blower and Forge Co. 45" cupola and forge blower.

1 Dunn Sutcliffe Furnace Co. (New Orleans) 5 x 8 horizontal center crank slide valve steam engine - 1" governor - 54" x 6" fly wheel.

1 8 x 8 horizontal right hand slide valve engine - cast iron sub-base, with outboard bearing, 1½" fly ball governor, 36" x 8" fly wheel and 16" - #88 sprocket.

1 A. S. Cameron Steam Pump Works (New York) size 5/B 7 x 5 x 13 horizontal single steam pump.

1 4 x 7 horizontal right hand slide valve engine - 20" x 6" fly wheel.

1 Curtiss & Curtiss - Forbes 8" geared power driven pipe threading machine, with countershaft.

<u>Building #1/A</u> (Pump House)

First Floor

1 Cameron horizontal single steam feed pump #17093.

1 Battle Creek Mach. Co. size 1 6 x 7 x 5 Marsh horizontal single steam boiler feed pump #10652.

1-1 - 8" steam, 2 - 4½" water and 2 - 5¼" vacuum cylinders vertical walking beam fly wheel type steam boiler feed pump, with 60" fly wheel.

2 Cameron 10 x 5 x 13 size D Special outside packed plunger horizontal single steam boiler feed pumps - #17026-12084.

Scales

Building #5 (Pan House)

First Floor

1 Fairbanks 23" x 31" single brass beam portable platform scale on wheels, drop lever, capacity 2000#.

Building #6 (Tank House)

1 Fairbanks 42" x 44" #4 single beam brass sliding poise dormant platform scale, double iron pillars, 3400# capacity.

Tanks

Building #5 (Pan House)

Third Floor

8 6' x 15' x 4' deep 1/8" iron open tanks, with 2" angle iron rim, 2" angle iron bracing, 60'-2" pipe, 6-2" elbows, 6 pcs. 3" x 12" cypress plank, 48' long, 54 pcs. 6" x 6" cypress blocking, 12" long.

1 8' x 10' x 68" deep 1/8" iron open tank, 2" angle iron rim, 4-3/4" cross rods, 2-3/4" long rods.

1 9' dia. 7' deep 1/8" iron open tank, 2" angle iron rim, 6-6" x 8" girders, 14' long, 1-10" x 10" post, 18' long, 1-8" x 8" cap, 9' long, 2-8" x 8" braces, 8' long.

Building #6 (Tank House)

6 25' dia. 12' deep ½" iron open tanks, 2" angle iron rim, 19" x 21" cast iron gate, operated by handwheel, rack and pinion.

1 6' x 15'2" x 4" deep 1/8" iron open tank, 16" x 16" cast iron gate, with hand wheel, rack and pinion, 6' x 15' platform, 21-6" x 8" posts, 42" long, 6-2" x 12" sills, 15" long.

1 8' x 10' x 67" deep 1/8" iron open tank, 2" angle iron rim, 16" x 18" cast iron gate, hand lever, 8-17" x 20" cypress blocks, 32" long, 1-6" x 6" cypress timber, 8' long, 1-6" x 8" cypress timber, 8' long, 2- 6" x 4" cypress posts, 26" long.

1 6' x 15' x 4' deep 1/8" iron open tank, 12-6" x 8" posts, 41" long, 3-2" x 12" caps, 15' long, 4-2" x 12" sills, 6' long.

1 19" x 84' - 1/8" iron tank trough, 12" deep at ends, 20" deep at center, 2" angle iron rim.

Trucks

Building #5 (Pan House)

Second Floor

1 iron sugar wagon, 36" x 48" at top, 30" x 40" at bottom, 32" deep, 2-9" wheels and 1 castor.

3 48" side 6' long at top tapering 1 end to 4' long 24" deep sugar wagons, 2-9" wheels and 1 castor.

Building #6 (Tank House)

36" x 48" top 30" x 40" bottoms 32" deep sugar wagons.

48" x 6' top 48" x 48" bottom sugar wagons, 24" deep.

tubular frame barrel barrow.

all iron barrel trucks.

16" x 60" warehouse truck, full ironed.

14" x 54" warehouse trucks, half ironed.

22" x 60" warehouse truck, half ironed.

George U. Borde, Consulting Engineer, Inventory of Laurel Valley Plantation, 1919

1 - American Hoist and Derrick Co.'s steel derrick, full circle swing, 60 ft. boom, steel cables, blocks, complete with vertical boiler and 5½" x 8" dbl. cyl. hoisting engine, complete with drum, etc.; set on circular brick foundation 8 ft. in diam. x 2 ft. above ground; with operator's house, built with 1 x 12 vert. siding & containing 628 bd. ft. framing lumber, 746 bd. ft. flooring, decking, etc., 144 sq. ft. asbestos roof & 6 glazed openings, erected.

Main cane carrier 6'6" wide x 168' lg. on centers, in brick well 62 ft. lg., & consisting of head shaft with gearings, sprockets, etc.; tail shaft with bearings and sprockets; approximately 60 sets 10" flanged idlers with shaft and bearings; 700 ft. 1¼" x 5/16" & 5/8" round link carrier chain.

1 - 10 prong Walsh patent cane feeder in operator's house containing 1023 ft. framing lumber, 466 ft. sheathing & siding; 3 glazed openings; 196 sq. ft. asbestos roof.

1 - 6 x 8 dbl. cyl. Lambert hoisting engine, complete with drum, etc., for cane feeder.

1 - 9 x 10 vertical G. & S. engine without flywheel.

1 - 6 x 8 dbl. cyl. Jackson Church Co. engine, with sprocket drive fpr carrier, set on crusher bed plate.

1 - 2-15/16" countershaft with sprocket & pinion for driving carrier, & 3" Lik belt; shaft on bearings on c.i. columns of cane carrier.

1 - Birmingham F.& M. Co. crusher with 34" x 6'6" rolls, erected on c.i. base plate on brick foundations 6'6" high above ground, and connected by compound gearing to

1 - 18" x 36" Birmg. F. & M. Co. Corliss engine with flywheel, etc., erected on brick foundations.

2 - trash elevators driven by link belt from sprockets on mill rollers.

Birmingham F. & M. Co. 3 roller 34" x 6'6" mill with standard housing, composed of gearing and hydraulic accumulator; gearing in steel housing; erected on c.i. base on brick foundations 6'6" high above ground.

1 - Birmingham F. & M. Co. 3 roller mill, same as above.

1 - intermediate carrier 24 ft. long between centers; sides 3" x 12" lumber; bottom 1 x 3 oak plank; 2 2½" link belt chains with 2" x 3" floats 24" centers; driven by link belt from sprocket on mill roller.

1 - 26" x 34" Birmingham F. & M. Co. Corliss engine with flywheel,

etc., complete on brick foundations.

2 - cast iron sulphur stoves with 6" pipe connections.

1 - 24" wide x 10 ft. long iron sulphur cooler.

1 6 x 9 Atlas center crank engine for driving sulphur mixer, on brick foundation 2'6" x 6'0" x 16" high.

1 3' x 18' wood juice tank & sulphur mixer, with shafts & bearings & 24' 6" rubber driving belt; 25' of 5" belt for countershafts; set on 2 brick piers 5' long x 21" high with 1" offsets to course.

1 - 8 x 7 x 10 Blake brass lined syrup pump.

1 - 9 x 8 x 10 Knowles brass lined syrup pump.

1 - 2'3" x 2'6" x 11'0" wood juice tank.

1 - 5'6" x 14'0" x 5'0" slop tank with angle iron at top.

1 - 5 x 3 x 7 Cameron steam pupm on plank foundation.

1 - 5 ft. kettle set in brick well on floor.

1 - 5 x 3 x 7 Cameron steam pump.

2 - 6 x 3 x 5 Guild & Garrison steam pumps.

2 - 5'6" x 14'0" x 5'0" deep slop tanks with angle iron on edges.

1 - 4' x 6' x 5' metal tank.

1 - 10 x 7 x 12 Dean circulating pump erected on concrete floor.

1 - 6 x 10 x 8 flywheel sweet water pump.

1 - 6 x 12 x 8 flywheel sweet water pump.

1 - 8 x 6 x 12 Blake steam pump.

1 - 12 x 18 x 10 Blake duplex flywheel vacuum pump with governor, etc.

1 - 14 x 10 x 30 Cameron circulating pump.

1 - 10 x 7 x 12 Dean duplex pump.

1 - 18 x 16 x 24 Blake circulating pump.

1 - 28" x 48" x 36" steel tank set in floor.

1 - 4 x 6 x 5 duplex steam pump.

5 - 12 ft. diam. x 6 ft. syrup tanks on continuous brick foundation 13' x 63' 12" above floor, with circular foundation 6" high under each tank.

1 - 18 x 24 x 24 Cameron vacuum flywheel pump with governor, etc.

2 - 6 x 6 x 6 Mc Gowan molasses pumps.

1 - 4 x 4 x 5 duplex pump.

1 - 4' diam. molasses tank with mixer, set in floor.

1 - battery of 6 - 36" Weston centrifugals with mixer, countershafts, belts, etc., complete; foundations below floor.

1 - 12" spiral conveyor 30' long, in wood box.

1 - belt elevator, 38 ft. to 3rd floor, for sugar from centrifugals.

1 - 8 x 10 Atlas center crank engine to drive granulators, set on brick foundation 2'6" x 7'0" x 15" high.

1 - 18 ft. Link Belt elevator to 2nd floor with 4 x 5 buckets.

1 - battery of 4 - 36" West Point centrifugals with mixer & countershaft (not in use).

1 - 10 x 24 A. & W. Denmead & Sons side crank engine for driving centrifugals set on 3' x 14' x 30" high brick foundation, with 151 ft. of 10" rubber belt to countershaft of centrifugals.

1 - 5 ft. diam. sugar melter, set in floor (not in use).

Countershaft for West Point centrifugals:
6' - 2-15/16" shaft
1 - 36 x 12 c.i. pulley
1 24 x 12 c.i. pulley
2 - hangers
2 - collars

5 - 10 ft. diam. x 7'6" Deming clarifiers, with cone-shaped bottoms.

2 - 42" x 13" Deming superheaters.

1 - 6 ft. diam. Deming eliminator.

1 - 3 x 6 x 8 Marsh air pump (not connected).

1 - 10 ft. double effect, complete, on steel I beams, carried on c.i. columns.

1 - 10 ft. diam. x 7' charging tank on timber foundations.

3 - 10 ft. diam. x 8 ft. lime tanks, on 2nd floor joists.

Hydraulic accumulators for mills.

1 - 36" wide x 20" deep steel trough from vacuum pan to mixer.

1 Harry Bros. #3 granulator with countershaft, etc.

5 - Whitney filter presses, 250 sq. ft. each.

4 - Meyer filter presses, 500 sq. ft. each.

1 - size 3 Cameron steam pump.

1 - 3'6" x 32" deep steel tank with angle iron at top.

1 - 4" x 8" side crank engine.

1 - 2" centrifugal lime water pump.

2 - 32" diam. x 3ft. deep lime water tanks.

1 - countershaft for washing machine.

1 - 3'6" diam. x 5'6" American Laundry Company washing machine.

1 - Power wringer.

1 - 4" x 8" side crank engine.

1 - lo' Birmingham F. & M. Co. vacuum pan, on c.i. columns.

1 - 7'6" vacuum pan on c.i. columns.

1 - battery of 2 - 8' copper evaporating pans with 2½" copper coils.

7 - 6' x 15' x 4' deep metal tanks, with angle iron at top.

1 - 6' x 15' x 4' metal tank with angle iron at top.

1 - 8' x 10'x 5' tank with angle iron at top.

1 - 10' diam. x 8' circultaing tank in roof, carried on 8 x 8 timbers bolted to bottom chord of trusses.

1 - 12 x 14 x 6 Guild & Garrison magma pump.

6 - 25' diam. x 12'6" tanks with gate operated by rack and pinion, and set on circular brick foundations, 25' diam. x 32" high.

1 - 2 ft. wide x 18" deep x 150 ft. long wood tank with branches from tanks to magma pump.

2 - 6' x 15' x 4' tanks on timber foundations.

1 - 8' x 10' x 6' tank on timber foundation.

5 - 15' diam. tanks with sloping bottoms, averaging 9 ft. in depth, with gates operated by rack and pinion; set on brick foundations 15 ft. diam. sloping from 48" high in rear to 32" in front.

1 - 20" wide x 18" deep x 104 ft. long steel trough with angle iron at top, and circular bottom.

3 - 4' x 21' x 4' tanks with galv. roof on wood sheathing on foundations consisting of
4 brick piers 136 bricks each
8 12 x 12 x 6' columns
4 12 x 12 x 16' girders
8 1½" x 8" x 16' under tanks
384 bd. ft. siding 1 x 12
384 bd. ft. flooring

3 - 6' x 15' x 4'6" tanks with galv. roof on wood sheathing on foundations consisting of
15 brick piers of 60 bricks each
15 6 x 6 - 4'9" timbers
3 6 x 6 - 22'0" timbers

1 - battery of 3 Baldwin sugar packers.

1 - bag holder and scale.

1 - Fairbanks 4' x 6' platform scale.

1 - worm gear freight elevator to 3rd floor, 5' x 6' platform.

1 - 8 x 12 Jewel side crank No. 5 engine complete with governor, etc. on brick foundations 4' x 6' x 6" above floor.

1 - #120 - 125 V., 120 A., 15 K.W. Triumph dynamo on wood foundations.

1 - Sprague motor unit with Harrisburg Foundry Co. 9 x 10 side crank engine & 125 V., 240 A. dynamo, all on c.i. bed plate on brick foundations 7' x 7' x 6" above floor.

1 - 4' x 5' marble switchboard on angle iron frame, with volt and ammeter switches, pilot lights, etc.

1 - 4' x 4' x 4' hot water tank.

1 - battery of 2 - 60" x 18' boilers with 44 - 4" tubes, in brick Dutch oven setting, with furnace and ash pit doors, breechen, etc.

1 - battery of 2 - 60" x 20' boilers with 44 - 4" tubes, similar to above boilers.

1 - battery of 2 - 60" x 20' boilers, same as above.

1 - battery of 2 - 60" x 20' boilers, same as above.

1 - battery of 7 - 6" x 18' boilers with 62 - 4" tubes, made in 1897, set in full arch fronts, etc., and equipped for burning oil.

Breechen for above boilers.

1 - 48" x 68 ft. smokestack, with 7' x 7' cast iron base.

Brick foundations for above stack - 7' x 7' x 23'6" high - 21,000 bricks.

1 - 60" x 68' smokestack on 8' x 8' x 1¼" cast iron base.

Brick foundations for above stack - 10' x 10' x 27' high - 34,272 bricks.

Steel bagasse carrier 34" wide, 14" deep, angles at top and bottom, carried on wood supports bolted to iron columns of building, with 3 trunks 30" high to each battery of boilers.

1 - 8 x 12 side valve engine, with sprocket to drive conveyor.

1 - 5 x 8 Dunn-Sutcliff side crank engine with governor, to drive blower.

1 - Champion blower, 14" with 30' - 5" rubber belt.

1 - Buffalo blower, #11.

1 - 9 x 18 side crank engine with outboard bearing, governor, etc., in 2'6" x 9'6" x 6'6" high brick foundation.

1 - 8 x 5 x 12 Knowles boiler feed pump on 1'4" x 5'0" brick foundation 15" high (connected to fire protection system).

1 - 8 x 4 x 12 Cameron steam pump No. 6 on brick foundation 1'4" x 4'0" x 16" high.

2 - 10 x 5 x 15 Cameron plunger pumps No. 10 on brick foundations 18" x 6'6" x 16" high.

1 - Size D Cameron steam pump on brick foundation 3'4" x 7'8" x 16" high.

1 - 7 x 5 x 10 Marsh steam pump on brick foundation 26" x 36" x 12" high.

1 - 10 x 5 x 12 Cameron steam pump, size 8.

1 - 6 x 3 x 8 Cameron steam pump, No. 2.

1 - walking beam flywheel vacuum pump, 12" steam cyl., 2 - 22" vacuum cylinders, all 36" stroke, on brick foundations 5' x 15' x 26" high.

1 - feed water supply heater tank consisting of old 2 flue boiler

44" x 36" on 2 brick piers each 18" x 50" x 30".

1 - 4 x 3 x 4 duplex steam pump.

2 - 4 x 3 x 4 duplex oil pumps.

1 - 1½" Niagara oil meter.

1 - 28" x 6' vertical boiler for starting oil furnaces.

1 - 2½" x 8" forbes pipe cutter and threading machine with counter-shaft.

1 - 4 h.p. Fairbanks water cooled gas engine to drive pipe cutter, set on brick foundation in galv, house 6' x 8' x 7', about 25' from building.

1 - 36" x 8'0" compressed air reservoir.

3 - reservoirs for automatic chemical fire extinguishers with pipes &outlets in main building & 2 outlets in boarding houses.

Outlets from fire protection pipe lines, each with 50 ft. 1½" canvas rubber lined hose.

350 - sugar cars.

Miscellaneous lot of machinery supplies, consisting of 1 - 60 h.p. Atlas engine without flywheel or fittings, 1 - 4" centrifugal pump with broke pulley and a lot of old and new pipe fittings, valves, etc. of all sizes.

1 - 15" x 3'6" portable chemical fire extinguisher on wheels.

ugar Drying—Seven 30" Hepworth cen-
ugals, on 15 x 24" Lane & Bodley slide
re engine.

Iagma Tanks—Four 25' diameter, 12'
h; two 16' diameter, 12' high.

oilers—For bagasse: One 300 h. p.
tch Marine boiler; four 48" x 22' with
" flues at 70 h. p.
or fuel oil: Two 72" x 18' b. r. t. at
h. p.; one 75 h. p. flue boiler.

uel Storage—One fuel oil tank, 4000-bbl.
acity.

iscellaneous—As a measure of protec-
against fire, the entire boiler depart-
t is of steel and sheet iron structure.
is is one of the few Louisiana sugar
ories which "came back" after destruc-
by fire. Factory was rebuilt in 1922
r fire loss grinding of 1921.

**LAURA FACTORY—700 Tons Capacity.**

**Waguespack & Haydel, Vacherie, La.**

ctory Operatives—Raymond Wagues-
General Manager; Albert Haydel, En-
r; Geo. Poche, Sugar Maker, the latter
aulina.

gars Made—Clarified.

ie Received—From two-thirds to three-
hs cane milled raised on owners' prop-
by wage and tenant system. Three
narrow gauge railway brings bulk of
to the mill, though fitted to handle
e crops over the Texas & Pacific
ay. Have 30 double truck steel cars
-ton acity, and one 10-ton Daven-
loco ve.

ried Feeding—No feeding of cane
tramcars: all car cane received in
and fed to carrier slide or stored
60-ft. boom Caflero derrick. Use der-
o store or feed cart cane as well.

Equipment—6-roll mill and crusher.
2 x 66" Fulton "Cora," run by Lane
lley Corliss engine; crusher 26 x 70"
wski, with inclined housing, run by
wski Corliss engine.

ification System—Open clarification:
larifiers 4 x 5 x 6'; 5 settling tanks
x 3', one 500 sq. ft. Murphy filter
two sets 200-bottle filters.

poration Equipment—9' Standard
effect: two vacuum pans, one 9' and

r Drying—Eight 30" Weston centri-
run by one Atlas slide valve engine.

ma Tanks—One 12' high by 30' di-
; four 12' high by 16' diameter.

rs—For bagasse, 1 300 h. p. Stirling
tube, 2 Scotch Marines of 400 h. p.
fuel oil, 4 42" x 20' flue boilers at
. each.

Storage—5000-bbl. oil tank.

llaneous—Exterior steel tower tank,
00-gal. capacity, connected to well
re protection lines throughout the

**EL GROVE FACTORY—1200 Tons Capacity.**

**Grove Company, Thibodaux, La.**

ry Operatives—J. T. Landalche,
r.; E. P. Lorio, Engineer; Peter
ux, Superintending Sugar Maker.

s Made—Granulated mainly; some

Rece —Produce about two-fifths
ne t e; buying most of remain-
m growers who deliver cane on
ux Branch T. & T. Ry. About 25%
eived by T. & P.; practically all
r delivered over plantation tram-
miles length, with 220 4-ton cars
locomotives; two Porters and one
rt engine.



**Carrier Feeding**—From cars with Walsh rae onto roller-chain carrier. Standard car cane handled by 60' steel American derrick and grab, feeding to carrier slide. Derrick stores big car cane as well to give quicker release to the rolling stock.

**Mill Equipment**—12-roll 32 x 78" mill, in tandem, with 26 x 78" Birmingham crusher; crusher on 22" x 42" Birmingham Corliss engine.
First two sets of mills Reading make, on 25½ x 48" Reading Baker slide valve engine.
Second two sets of mills Whitney make, on 30 x 48" Whitney Baker piston valve engine.

**Clarification System**—Four liming and measuring tanks, 8' diameter, 10' depth. Three 500-sq. ft. Murphy pressure juice heaters. Three closed Deming settlers, one 12', two 11' diameter.
For good sugar production use set of 10 bag filters, each with 200 bottles.
Mud press equipment: Six 400-sq. ft. Eclipse and 6 500-sq. ft. Murphy presses.

**Evaporation Equipment**—One Standard triple effect: 1st and 2d bodies 9' diameter (equipped with Webre baffles to increase capacity) and 3d body 11' diameter. The effects are arranged so as to be operated as a double when crowding, then running the 1st and 2d body as one.
Vacuum pans: Two 10' high pressure pans; one 8' low pressure.

**Sugar Drying**—Nine 40" American Westons; four used on 1sts being equipped with dischargers. The 9 machines hooked onto one engine, 16 x 36" Hamilton Corliss.
For finished sugars use two-floor double system Hersey granulator, 5 x 23'. In connection with granulated production use automatic weigher for packing in 100-lb. and 25-lb. pockets.

**Magma Tanks**—Eight tanks for 3ds 15' deep, 25' diameter, of 50,000-gal. capacity each.

Likewise usable as either magma or molasses storage, but utilized more for latter, are two extra large tanks, one 22' deep, 35' high; the other 25 x 37'.

**Boilers**—For bagasse: One 250 h. p. Scotch Marine; two h. r. t. 96" x 20' (with 128 4" tubes) of 225 h. p. each; ten 60" x 16' h. r. t. at 90 h. p., these two set in nests of two.
For fuel oil: One 250 h. p. Scotch Marine boiler; two 60" x 16', at 90 h. p.
Principal stack service afforded by self-supporting smokestack 75" x 125'; two smaller stacks also used.

**Fuel Storage**—One 6000-bbl. fuel oil tank at bayou front; connected by pipe line to a 5000-bbl. storage tank near the factory.

**Miscellaneous**—Water protection afforded by 35,000-gal. watertank on 75' steel tower; with gasoline engine pump connection.
Water supply for general factory purposes pumped from Bayou Lafourche with a 30 h. p. crude oil engine.
Has extra large warehouse for sugar storage, 60 x 250', all steel structure, and capable of housing the equivalent of 10,000 barrels of sugar.
Hot room for 2d sugars encloses 14 rectangular tanks, 18 x 8 x 6', with inclined bottoms. These sugars heated with hot-air blast instead of usual piping system, with better results obtained because of more uniform temperature and better control of heat.

**LAUREL VALLEY FACTORY—800 Tons Capacity.**

**Barker & Lepine, Lafourche, La.**

**Factory Operatives**—J. W. Lepine, General Manager; John LeBlanc, Engineer; J. W. Lepine, Jr., Chemist.

**Sugars Made**—First sugars turned out only in form of plantation granulated; second sugars also made.

**Cane Received**—Average of about 50% of all cane milled is bought. A sixth of the cane milled is usually received by barge, handled at Bayou Lafourche landing with 60-foot American steel derrick, the cane bundled in slings, transferred loose to the mill via 36-inch tramroad. Bulk of the cane delivered to the mill received over 15 miles of tramroad, using 250 five-ton cars, with one Baldwin and one Porter locomotive.

**Carrier Feeding**—Walsh feeder from narrow gauge cars. No cane delivered to the mill in other than narrow gauge cars.

**Mill Equipment**—6-roll Birmingham mill, 34 x 78", preceded by 26 x 78" Birmingham crusher. Mill operated by 26 x 54" Birmingham Corliss engine, and crusher by 13 x 36" Birmingham Corliss engine.

**Clarification System**—3 liming tanks, 10' diameter by 9' high; two 500 sq. ft. Murphy pressure juice heaters; 6 conical open settlers, 10' diameter by 7' high. Bottoms from settlers handled by two 500 sq. ft. Moresi presses, and four German presses, each 500 sq. ft.

**Evaporative Equipment**—9' Standard double effect: one 10' and one 7' vacuum pans. Charge tank to effects, 6 x 10' diameter; 6 syrup tanks 6 x 14' diameter.

**Sugar Drying**—Battery of six 30" Weston centrifugals for first sugars, and four 30" Hepworths for second sugars; all machines run by one slide valve engine, 12 x 28". One Harry granulator.

**Magma Tanks**—Six 25' diameter by 15' high; six 16' diameter by 10' high. The smaller six tanks have inclined bottoms, with one foot drop across width of tank for easy outflow of bottoms.

**Boilers**—Bagasse fired, eight 56" x 18' b. r. t. of 85 h. p. each. Seven oil-fired boilers, same type, dimension and rating.

**Fuel Storage**—Two oil tanks, each of 7000 bbls. capacity.

**Miscellaneous**—24,000 gal. outside water tank on 77 ft. steel tower elevation. Inside of factory 21 hose openings, 1¼ inches; outside of factory 7 hose openings, 2½ inches, also chemical fire extinguishers in the factory with connection to three stations. Underground 8" water main surrounding factory with six hydrant stations and reel of 500 ft. hose, besides three more water openings in the quarters around the factory.

**LEIGHTON FACTORY—1000 Tons Capacity.**

**C. Lagarde Co., Ltd., Thibodaux, La.**

**Factory Operatives**—Dr. A. J. Price, General Manager; J. C. Ward, Chief Engineer; Chas. Vives, Sugar Maker, the latter of Donaldsonville.

**Sugars Made**—Raws, mainly; some granulated.

**Cane Received**—About a fifth of tonnage brought in from Teche country over Southern Pacific Ry. A considerable proportion by barge from lower Lafourche points, the remainder over 9-mile tramroad with 170 5-ton cars and 3 locomotives, two 10-ton Porters and one 15-ton Vulcan. Use 18 100-ton capacity barges for Bayou Lafourche cane delivery; cane transferred from barges to small cars by 50' steel American derrick and grab.

**Carrier Feeding**—By rake with tramcar cane; by overhead grab and trolley system to handle 20,000 tons standard car cane. As auxiliary feed for standard car cane have 60' steel American derrick and grab. Trolley feeds cane on cross-carrier 18' wide by 26' long, emptying into main roller-chain carrier.

Addendum To:
LAUREL VALLEY SUGAR PLANTATION: SUGAR MILL
2 miles south of Thibodaux on
State Route 308
Thibodaux
Lafourche Parish
Louisiana

HAER NO. LA-1A

HAER
LA,
29-THIB,
1A-

PHOTOGRAPHS

Historic American Buildings Survey
National Park Service
Department of the Interior
Washington, D.C. 20013-7127

ADDENDUM TO
LAUREL VALLEY SUGAR PLANTATION, SUGAR MILL
Two Miles South of Thibodaux on State Route 308
Thibodaux
Lafourche Parish
Louisiana

HAER No. LA-1-A

HAER
LA,
29-THIB,
1-A-

XEROGRAPHIC COPIES OF COLOR TRANSPARENCIES

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
Washington, D.C. 20013